

# **MASTER'S THESIS**

## **Master's in public health nutrition**

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Nutritional status and infant and young child feeding practices among  
children 0-24 months of age in urban and rural areas of  
east-central Nepal

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## List of abbreviations

ANC	Antenatal care
DHS	Demographic and Health Surveys
FCHV	Female Community Health Volunteers
HAZ	Height-for-age
ICN2	the Second International Conference on Nutrition
IYCF	Indicators for assessing infant and young child feeding practices
LMIC	Low- and middle- income countries
MDGs	Millennium Development Goals
NCDs	Non-communicable diseases
NDHS	Nepali Demographic and Health Survey
NGO	Non-governmental organization
NSD	Norwegian Center for Research Data
PNC	Postnatal care
REK	Regional Committees for Medical and Health Research Ethics
SDGs	Sustainable Development Goals
UN	United Nations
UNICEF	United Nations Children's Fund
WAZ	Weight-for-age
WHO	World Health Organization
WHZ	Weight-for-height

## Abstract

**Background and aim:** Poor feeding practices leads to child malnutrition and consequently impaired physical and cognitive development. The objective of this paper is to describe nutritional status, infant and young child feeding practices, and access to health care in children 0-24 months, in urban and rural areas of Nepal, and to explore predictors for nutritional status.

**Methods:** A cross-sectional study was carried out among 111 mother-child pairs, by convenience sampling. Data were collected using the World Health Organizations indicators for infant and young child feeding practices, and the children's anthropometrics were measured. Correlation tests were used to measure differences between urban and rural areas and predictors for undernourishment were explored in multiple regression models.

**Results:** Underweight, wasting and stunting was found in 12.6%, 9.0% and 20.7% of the children respectively. The rate of exclusive breastfeeding was 80%, early initiation of breastfeeding was reported by 71% of the mothers, and timely introduction to complementary foods was found in 96% of the infants. The minimum dietary diversity was consumed by 47% of the children, and 43% received a minimum acceptable diet. Snack foods such as biscuits, chips, and chocolates, were consumed by 59% of the children in the past 24 hours. No significant differences were found between children in urban and rural areas with respect to access to health care, feeding practices or nutritional status. However, stunting was substantially higher among children in rural areas. Maternal school level; number of children; number of antenatal visits; and number of children were found to be predictors of undernutrition.

**Conclusions:** Findings of this paper indicate that suboptimal feeding practices and undernutrition exist across urban and rural areas. Early childhood nutritional interventions are necessary to prevent child undernutrition.



## 1. Background and study objectives

Adequate nutrition is crucial for a child's development, and malnutrition is a leading cause of childhood morbidity and mortality (Lu, Black, & Richter, 2016; Walker et al., 2011; Walker et al., 2007). Malnutrition in terms of undernourishment compromises a child's immune-function, lowering its disease tolerance and resilience (Development Initiatives, 2017), and predispose the child to the development of chronic and non-communicable diseases (NCDs) later in life (United Nations Children's Fund [UNICEF], 2013). The impact undernourishment has on cognitive and physical development may pass through generations, depriving people of the opportunity to reach their full potential and ability to step out of poverty (UNICEF, 2013; World Health Organization [WHO], 2018b).

The first 1000 days after conception, is considered the "critical window" for a child's physical and mental development (Pan American Health Organization [PAHO], 2003; Walker et al., 2011; WHO & UNICEF, 2008). Recovering lost potential caused by malnourishment, proves difficult after the child has reached two years old (Save the Children, 2018; UNICEF, 2013; Victora et al., 2016; WHO & UNICEF, 2008).

Exclusive breastfeeding for the first six months and timely introduction of complimentary food are found to be highly beneficial for a child's health (R. E. Black et al., 2013). Inappropriate breastfeeding and complimentary feeding practices are the main causes of undernutrition, along with disease such as diarrheal disease, which is often caused by poor hygiene (R. E. Black et al., 2013). An estimate of 823 000-child deaths could be prevented with appropriate breastfeeding practices (Victora et al., 2016).

Improving child-nutrition is a crucial step in improving global nutrition. In order to gain knowledge about child feeding practices through population-based surveys, the World Health Organization (WHO) has developed a set of indicators for assessing infant and young-child feeding practices (IYCF). Many initiatives have been implemented to tackle the complex and global burden of malnutrition, resulting in a substantial reduction in undernourishment over the past decades (Development Initiatives, 2017). These include the Sustainable Development Goals, (SDGs), where four out of 17 are nutrition specific; the 2012 World Health Assembly's approved implementation plan of six, global targets, aiming to improve infant, young child, and maternal nutrition (WHO, 2014a); and in 2014 the United Nations (UN) declared 2016-2025 as *the decade*

*of action on nutrition* (WHO, n.d.-b). However, world hunger remains an eminent problem (Development Initiatives, 2017), and maternal and child undernutrition still account for 11% of the global burden of disease (International Food Policy Research Institute, 2016; WHO, 2014a). Globally, over half of the children under the age of five who are stunted live in Asia (UNICEF, WHO, & World Bank Group, 2017) and in 2016 more than 61 million and 27 million children under the age of five in Southern Asia were stunted and wasted, respectively (UNICEF et al., 2017).

In low-income countries, children living in urban areas are less likely to be undernourished than those living in rural areas, due to favorable socioeconomic conditions (Smith, Ruel, & Ndiaye, 2005). Advantages such as better access to health-care facilities, a diversified job market and education in urban areas (United Nations, Department of Economic and Social Affairs, & Population Division, 2014) contribute to the rapid urbanization of low- and middle- income countries (LMIC) (WHO, 2018b). This trend of urbanization and economic growth in LMIC pose a new set of challenges, including nutrition transition, where the consumption of commercial processed foods and snacks increases drastically, contributing to child malnutrition (Popkin, 2001; Popkin, Adair, & Ng, 2012; Pries et al., 2016; Pries et al., 2017).

Nepal is one of the poorest countries in the world, with several nutrition-related health challenges (WHO, 2015). According to the Nepali Demographic and Health Survey (NDHS) from 2016, 36% of children under the age of five are stunted; 10% are wasted and 27% are underweight, with higher prevalence in rural areas for all three indicators (Ministry of Health Population, New ERA, & ICF, 2017). Over the past two decades there has been a parallel development of improved breastfeeding practices and a significant reduction of undernutrition in Nepal (Ministry of Health and Population, New ERA, & ICF, 2012; Ministry of Health Population et al., 2017). There has however been a decline in exclusively breastfed children in the past five years, and barely over one-third of the children received a minimum acceptable diet. Additionally, the unevenly distributed burden of undernutrition in rural versus urban areas persists (Ministry of Health and Population, 2012; Ministry of Health Population et al., 2017).

In this study we describe nutritional status, breastfeeding practices, complementary feeding, and access to health care in children 0-24 months of age in urban and rural areas of Nepal. Further we explore predictors for nutritional status among the children. To our knowledge there are no

recent studies addressing such wide range of variables linked to infant and young child feeding practices in children 0-24 months and comparing urban and rural areas in Nepal.

Two students from Oslo Metropolitan University (OsloMet) went to Nepal for nine weeks from early September to early November 2017, to collect data for their master's thesis projects. The data collection was conducted in collaboration with an international non-governmental organization (NGO) based in Europe.

### 1.1. Objectives and research questions

The main objective of this study was to describe nutritional status, breastfeeding practices, complementary feeding practices, and access to health care services in children 0-24 months of age, in Nepal. We included children from urban and rural areas.

#### 1.1.1. Specific objectives

1. Describe nutritional status (stunting, wasting and underweight) among children 0-24 months of age and explore differences in nutritional status between children in urban and rural areas.
2. Describe breastfeeding- and complementary feeding practices and explore differences between children in urban and rural areas.
3. Describe differences in the access to health care between children in urban and rural areas.
4. Explore associations for nutritional status among children 0-24 months of age.

### 1.2. Collaborations

The study was conducted in collaboration with a Europe-based, international non-governmental organization (NGO). The NGO's vision is to improve maternal and child health through providing information and treatment. Their projects are based in the Bode, Thimi region outside the capital city of Nepal, Kathmandu. Their main projects in the city of Bode, are in collaboration with a local health clinic. In Bode, mothers are invited to participate in a program that offers e.g. home visits antenatal and postnatal check-ups, with focus on the infant's health, and offering the mothers advice on breastfeeding and nutrition etc. They also have outreach camps, where they aim to reach the ones living in the surrounding, rural areas and who cannot access the clinic in Bode.

Elaborations on background and theoretical aspects, methods, discussions of methodological issues, and further discussions of results follows in the next chapters. The general objective and research questions will be addressed in an article written in accordance with author guidelines for publications in the MDPI journal *Nutrients*.

## 2. Theory

### 2.1. Nutrition in the global context

The global focus on nutrition has increased, but still; out of the world's 7 billion people about 2 billion suffer from micronutrient malnutrition, and nearly 800 million people suffer from undernourishment. At the same time 41 million children under the age of five are overweight (International Food Policy Research Institute, 2016). Between 2010 and 2015 the estimated percentage of stunted children under the age of five in the world was 14% (UNICEF, 2016). In 2016 the estimated global burden of acute undernourishment (wasting) in children, under the age of five, was 7.7% (UNICEF et al., 2017). More than half of the global burden of wasting, 27.6 million children, live in Southern Asia (UNICEF, 2016). The global burden of chronic undernourishment (stunting) in 2016 was approximately 23% in children under the age of five. Stunting is now considered the key marker for tracking undernutrition in children globally and has replaced underweight as an indicator of progress of nutritional status (UNICEF, 2016; WHO, 2018b). Southern Asia, together with Sub-Saharan Africa, has some of the world's highest rates of malnutrition. Between 2010 and 2015 the highest prevalence of moderate and severe undernutrition was found in Southern Asia, with underweight, stunting and wasting found in 30%; 37% and 15% of children under the age of five, respectively (UNICEF, 2016). Since the year 2000 there has been a 35% decrease in stunting and in Asia (UNICEF et al., 2017), however there are still 61.2 million stunted children in Southern-Asia, and the current rate of reduction in child malnutrition is not high enough to reach the goals of 2025 (WHO, 2017a).

### 2.2. Indicators of undernutrition

Deficiencies, excesses, or imbalance in energy and/or nutrient intake is defined as malnutrition (WHO, 2017b). Undernutrition is a type of malnutrition and includes underweight (low weight-for-age); acute undernourishment, known as wasting (low weight-for-height); and chronic undernourishment, known as stunting (low height-for-age) (WHO, 2017b). Table 1 show the

prevalence cut-off values for underweight, wasting and stunting defined by WHO, for the indication of public health significance. Low and acceptable prevalence of undernutrition, stunting and wasting are defined as under 10%, under 20% and under 5%, respectively (WHO, 2010b).

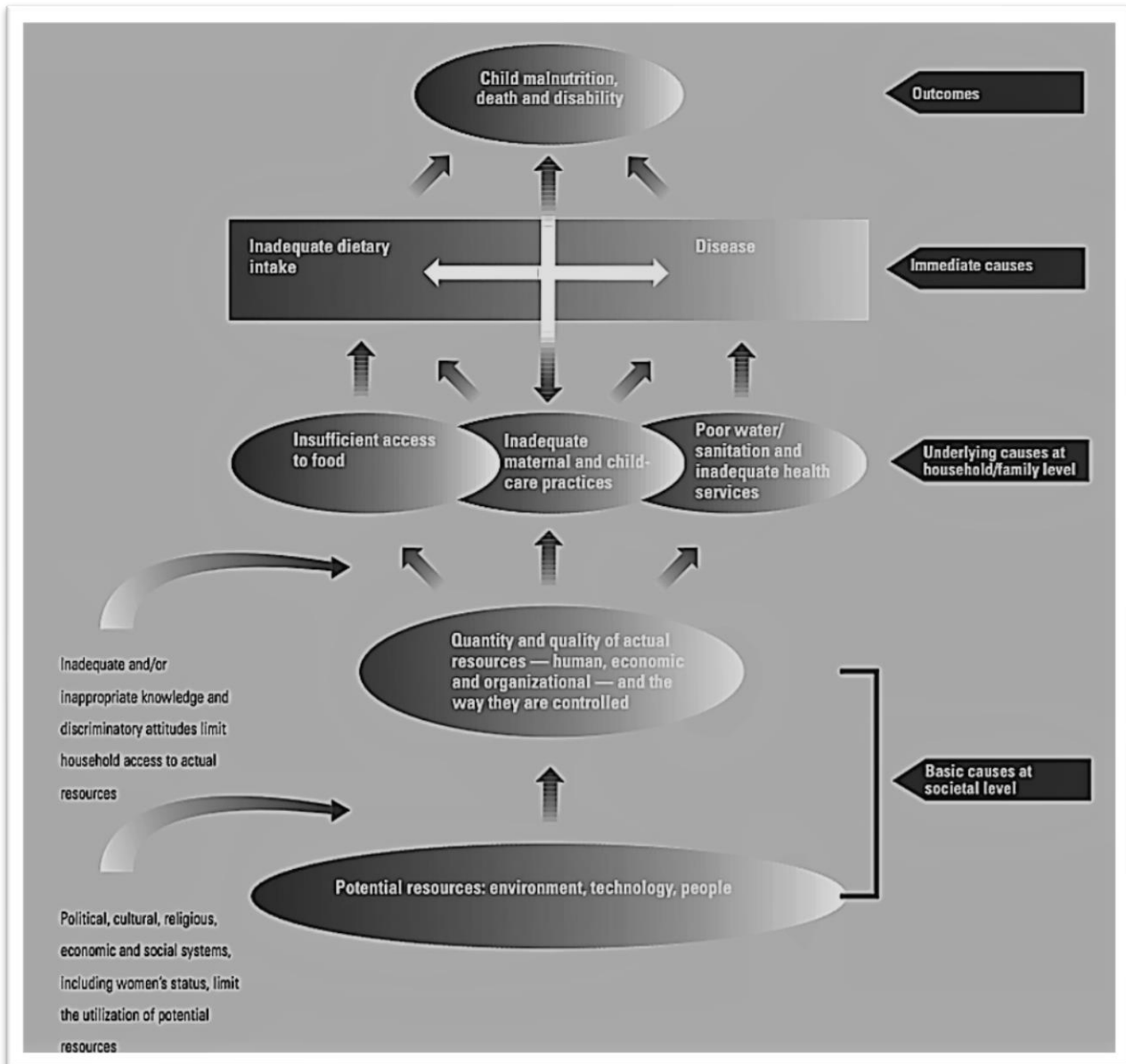
**Table 1.** Prevalence cut-off values for indicators of undernutrition

<b>Indicator</b>	<b>Prevalence cut-off values for public health significance</b>
<b>Underweight</b>	<10% Low prevalence
	10-19% Medium prevalence
	20-29% High prevalence
	≥30% Very high prevalence
<b>Stunted</b>	<20% Low prevalence
	20-29% Medium prevalence
	30-39% High prevalence
	≥40% Very high prevalence
<b>Wasted</b>	<5% Acceptable
	5-9% Poor
	10-14% Serious
	≥15% Critical

(WHO, 2010b)

### 2.3. The UNICEF conceptual framework and causes of malnutrition

The UNICEF conceptual framework was developed as a tool to define the different, interrelated determinants and causes of malnutrition (UNICEF, 1998). The framework is divided into levels, classified as: *basic causes*; *underlying causes*, *immediate causes*, and *consequences* (Figure 1). In this study the focus is on underlying and immediate causes of undernutrition, specifically.



**Figure 1:** The UNICEF conceptual framework on causes of malnutrition (UNICEF, 1998)

### 2.3.1. Basic causes

The basic causes of malnutrition are the potential resources available, in terms of environment, technology and people. The utilizations of such resources are limited by politics, culture, religion and economic- and social systems, including women's status (UNICEF, 1998). Inadequate and/or inappropriate knowledge and discriminatory attitudes influence the quantity and quality of actual resources, and the way they are controlled. This may limit household access to actual resources (UNICEF, 1998).

### 2.3.2. Underlying causes

Underlying causes of malnutrition are divided into three clusters: *Insufficient access to food*, referring to financial, physical, and social accessibility (UNICEF, 1998). For example, people, especially in rural areas, are dependent on their own ability and possibility to grow, store and sell food crops, and people in urban areas are dependent on what is available in local stores, and income in accordance to food prices; *Inadequate maternal and child-care*, including practices such as a child not being exclusively breastfed until six months of age, the child being introduced to complementary foods too early, too late or in insufficient amounts, and discrimination of gender and age, in terms of who gets the food available in a household. This also includes not seeking or receiving proper care, for example women not being able to access or attend antenatal and postnatal care programs (UNICEF, 1998). And finally, there is *Inadequate health services, and poor water and sanitation*. Inappropriate living conditions with for example poor water quality and sanitation practices cause infectious diseases such as diarrhea or foodborne diseases, such as parasites. When health care services are not available for the treatment and prevention of disease, this affect the levels of morbidity and mortality in the area (UNICEF, 1998).

### 2.3.3. Immediate causes of malnutrition

The two immediate causes of malnutrition in children are inadequate dietary intake and disease. These causes also affect each other, meaning poor feeding practices leave the child more prone to disease, which in turn leave the child more prone to becoming malnourished.

#### *Disease affecting nutritional status*

Disease such as diarrhea cause malabsorption of nutrients and a loss of appetite, and can over time lead to malnutrition (UNICEF, 1998). Diarrhea may be caused by poor hygiene, poor water quality and inappropriate complimentary feeding (Development Initiatives, 2017), and is one of the major immediate causes of undernutrition in children (Richard et al., 2013; UNICEF, 1998).

#### *Breastfeeding*

Measures such as increased rates of exclusive breastfeeding and optimal complimentary feeding practices will have great, positive impact on infant morbidity and mortality (Rollins et al., 2016; WHO, 2014a).

Breastfeeding is incomparably the best way of providing ideal nutrition for an infant, and the benefits of breastfeeding are well established (M. M. Black et al., 2017; Walker et al., 2011). Children under the age of two who are breastfed have a lower morbidity and mortality rate and less chance of developing chronic diseases later in life (WHO, 2014b). The short-term effects of breastfeeding include protection against child morbidity, such as diarrhea and respiratory disease, and against child mortality (Victora et al., 2016). The long-term effects of breastfeeding include protection against NCDs such as diabetes type 2, and lead to higher intelligence performance (Victora et al., 2016). Exclusive breastfeeding particularly has major preventative health benefits and provides the optimal foundation for cognitive and sensory development (M. M. Black et al., 2017; Walker et al., 2011). The WHO recommends exclusive breastfeeding until six months of age, and complementary food with continued breastfeeding up to two years of age and beyond (WHO, 2014c). Optimal nutrition and feeding practices, such as following the recommendations on breastfeeding, are important for the reduction of infant mortality, and also an important first step out of poverty (UNICEF, 2016).

### *Complementary feeding*

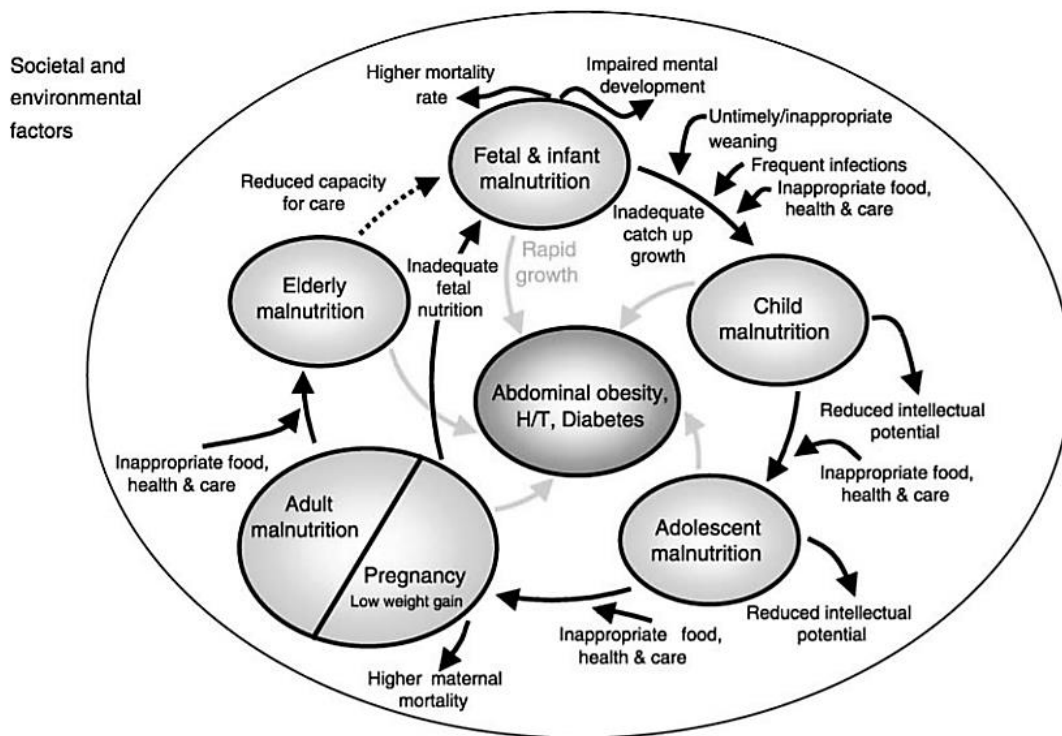
Complementary foods should be introduced as the child's energy and nutrient requirements increase, and breastmilk alone can no longer suffice for the continuing of optimal growth. The child is extra vulnerable in the transition when introduced to complementary feeding, and access to information on what sufficient and safe complementary feeding practices entails is important (WHO & UNICEF, 2003). Complementary feeding should be timely, adequate, and appropriate (WHO, 2017a), meaning a child should receive foods in addition to breastmilk (or formula milk) from six months and onward. Additionally, it is recommended that a child should receive a diverse diet, at a frequency that is age-appropriate (Table 4) (WHO, 2008). If the increasing nutrient requirements are not met, over time the child will consequently become undernourished, leading to impaired physical and cognitive development, and a child more prone to disease (R. E. Black et al., 2008). Every year an alarming number of infants die as a result of diarrheal disease and acute respiratory infections, caused by inappropriate feeding practices (WHO & UNICEF, 2003).



The consumption and availability of commercially processed foods are increasing in low-and middle-income countries (LMIC) because of nutrition transition (Popkin, 2001; Popkin et al., 2012; Pries et al., 2017). Nutrition transition is defined as the dietary shift toward higher consumption of foods high in fat, salt and added sugar, coinciding with economic and demographic changes (Popkin, 2001). Early introduction to- and high consumption of- commercially processed snack foods in LMIC may have a negative effect on nutritional status, especially if they replace other more nutrient dense alternatives (Pries et al., 2016).

#### 2.4. Consequences of undernutrition

According to the United Nations Children’s Fund (UNICEF) rapport *The State of the World’s Children 2016*, about half of all deaths in children are attribute to undernutrition (UNICEF, 2016). An undernourished child, possibly undernourished even prenatally, may suffer a myriad of consequences. As illustrated in the figure below (Figure 2), causes and consequences of malnutrition varies throughout life (ACC/SCN, 2000). If undernourishment is not addressed before the “critical window of opportunity” closes, the consequences may last a lifetime (Save the Children, 2018; UNICEF, 2013; Victora et al., 2016; WHO & UNICEF, 2008) and potentially pass down through generations. Malnutrition in all forms is also costly, affecting human capital and social progress, as well as depriving a person the chance of developing to their full potential and stepping out of poverty (ACC/SCN, 2000; WHO, 2018b).



**Figure 2:** Nutrition throughout the life cycle (Darnton-Hill, Nishida, & James, 2004)

### 2.5. Global incentives on Malnutrition

Improved nutrition is considered a gateway to achieve world development, and global initiatives through for example the UN system has set nutrition on the agenda (WHO, n.d.-b). As a continuum of the eight Millennium Development Goals (MDGs) the UN has formulated the Sustainable Development Goals (SDGs): 17 goals of which 12 of them require good nutrition to be met (International Food Policy Research Institute, 2016; United Nations, n.d.). In 2015, the 17 Sustainable Development Goals were adopted “to end poverty, protect the planet, and ensure prosperity for all...”. The nutrition specific Millennium Development Goals 1, 4 and 5: *eradicate extreme poverty and hunger, reduce child mortality, and improve maternal health*, respectively, have been incorporated especially into the Sustainable Development Goals 1, 2, 3 and 10: *No poverty, zero hunger, good health and well-being, and reduced inequalities* respectively (United Nations, n.d.; WHO, n.d.-a). In 2012 the UN and the World Health Assembly approved the implementation plan of six, global targets aimed to improve infant, young child, and maternal nutrition. The first goal is to reduce the number of children under the age of five who are stunted by 40%; reducing and maintaining childhood wasting to less than 5%; and increasing the rate of

exclusive breastfeeding in the first six months to at least 50% (WHO, 2014a). In addition to these goals, at the Second International Conference on Nutrition (ICN2) in 2014, the Nutrition Decade was established, and the UN declared 2016-2025 as *the decade of action on nutrition* (WHO, n.d.-b). The vision seeks a decade of action on nutrition with a world, including organizations and other stakeholders working with nutrition, that collaborate on actions providing access to an affordable, diverse, safe, and healthy diet to all people at all times and all stages of life (WHO, n.d.-c). Despite the many initiatives attempting to improve the world's burden of malnutrition, and the fact that several countries are on course to reach their country goals, often the most marginalized and vulnerable, such as women and children, are not reached. Additionally, a country's mean or total percentage of health indicators may mask stagnated or adverse development in specific population groups or regions (Every Woman Every Child & Partnership for Maternal, Newborn and Child Health [EWEC] 2017). Even in countries with great political efforts, for example for improved health care, major disparities and inequity may exist within a country (EWEC, 2016; UNICEF, 2016; WHO, 2015). Further, the rapid urbanization of LMICs poses new challenges, such as those associated with urban poverty and nutrition transition (Popkin, 2001; UNICEF, 2013). Important measures for child malnutrition prevention are improving mothers' access to information on optimal child nutrition, and intervention promoting especially exclusive breastfeeding the first six months of a child's life (WHO, 2018b).

## 2.6. Child health and malnutrition in Nepal

According to the Nepali Demographic and Health Survey (NDHS) the prevalence of undernutrition in Nepal is high, with 36% of children under the age of five being stunted; 10% being wasted and 27% being underweight (Ministry of Health Population et al., 2017; WHO, 2010b). In Nepal 66% of infants were exclusively breastfed at six months in 2016, a reduction from 70% in 2011. At the age of one, 94% of the children were still breastfed, and 87% were still breastfed at two years of age (ARCH, 2017; Ministry of Health, New ERA, & ICF, 2017). Among children six to 23 months of age, 53% did not reach the minimum dietary diversity, and only 36% consumed what is considered a minimum acceptable diet (Ministry of Health Population et al., 2017).

There has been a reduction in infant mortality in Nepal over the past two decades, and a comparison of NDHS reports from 2011 and 2016, shows the under-five mortality rate was

reduced from 54 to 39 per every 1000 births (Ministry of Health et al., 2017). According to NDHS reports, health data also indicates major differences between rural and urban populations in Nepal. Health and nutrition indicators such as underweight, stunting and wasting in children under the age of five, and infant and under-five mortality were substantially higher in rural areas (Ministry of Health et al., 2017; Ministry of Health and Population, 2012).

In Nepal the community-based approaches adopted by the public health system have been important for maternity-, infant- and child health, especially in remote, rural areas (Ministry of Health and Population Nepal, 2014; UNICEF, 2013). A prime example of such a system is the well-established, community-based, health care system of Female Community Health Volunteers (FCHV). This is an initiative involving local women, providing them basic health training, to work as volunteers promoting infant and maternal health in their local community. In the improvement of maternal mortality in Nepal, the role of FCHV is of tremendous importance (Ministry of Health and Population Nepal, 2014; UNICEF, 2013).

Despite political effort to improve national health there is a divide between availability in offered health care and aid, and subsequently the role of NGOs may be of great importance for any health care for some groups (EWEC, 2016; WHO, 2015).

### 3. Methods and Materials

This chapter describes the study design used, sample and sampling procedures, method for data collection, how the collected data were managed and what statistical analysis were used. The study utilizes the WHO's *Indicators for assessing infant and young child feeding practices* (IYCF) (WHO, 2008, 2010a).

#### 3.1. Study design

The study was conducted using a cross-sectional design, with the indicators measured in the participants at one point in time (Krokan, 1995). The study was conducted in Bode, Thimi and Nagarkot in the Bhaktapur district and the Kushadevi area in Kavrepalanchok district from September to November 2017.

### 3.2. Sample

The World Bank's latest estimate for the population of Nepal for 2016 is 28.98 million people (The World Bank, n.d.). According to the 2011 census from Nepal, the municipalities Madhyapur Thimi, Nagarkot and Kushadevi had 94,721 registered inhabitants, where approximately half of them were women (Government of Nepal, National Planning Commission Secretariat, & Central Bureau of Statistics, n.d.).

The target group of the study was mothers with children 0-24 months of age, living in urban or rural areas in the two districts. Children who were born severely premature were excluded from the study. Data collection was conducted through convenience sampling in one urban and two rural areas in the district of Bhaktapur and the district of Kavrepalanchok from September 16th through November 1st, 2017.

#### 3.2.1. Sample size

In 2017 a total of 356 women were reached with the NGO's home visits program, and a total of 157 women were reached through the three, scheduled outreach programs in which the data for this study were collected. sample size was calculated using the software program Epi Info *StatCalc, version 7.2.2.6* (Epi Info). Calculations were made using a statistical power of 80%, a 5% margin of error and two clusters (rural and urban), resulting in a total sample size of 106 and a cluster size of 53.

The final sample collected for this study consisted of 111 women and 111 children. A total of 47 mothers and children participated from rural areas whereof 23 were from Nagarkot and 24 from Kushadevi, and 64 participated from urban areas, whereof 24 were from the NGO's clinic and mothers' group; 33 from home visits and seven from other settings. How many mothers declined to the offer of participating in the study is unknown.

#### 3.2.2. Sampling procedure

There were no public health records available for the researcher to use for a probability sampling method, hence convenience sampling was suited as sampling method in the circumstance of this study.

Mothers from urban areas were recruited in Bode/Thimi, a municipality in the district of Bhaktapur, primarily at the clinic where NGO is located, and through the NGO's home visit programs. Mothers recruited at the clinic through the NGO's mothers' group, were either addressed before or after the group meetings. The mothers whom were recruited through the home visit program were visited in connection with the NGO's second or third home visit, for a general checkup. Some mothers were recruited through unscheduled visits to local carpet factories. The mother was then offered the opportunity to answer the questionnaire for this study.

Mothers from rural areas were recruited through NGO's outreach program. At the time of the study the NGO had three outreach camps: two in Nagarkot municipality and one in Kushadevi, a rural area in the district of Kavrepalanchok. Here the mothers were offered the opportunity to participate in the study after receiving a general health check-up, including anthropometric measurements of their child.

### 3.3. Preparations before leaving

Before leaving for Nepal a draft of the questionnaire was developed, as well as a draft for how to use the questionnaire for the fieldworker training. An application was submitted to the Norwegian Center for Research Data (NSD) and a draft for the *Letter of consent*, for participating mothers to sign, was developed.

## 3.4. Data

### 3.4.1. Questionnaire

The data were collected using a structured questionnaire. The questionnaire was developed based on the WHO's *Indicators for assessing infant and young child feeding practices* (IYCF) (WHO, 2008, 2010a) and the Demographic and Health Surveys (DHS) program's *Household questionnaire* (Ministry of Health Population et al., 2017). The questionnaire consisted of 57 questions divided into three modules: *Background*, including background variables such as child's gender, age, level of education of parents, ante- and postnatal care and socioeconomic indicators (Table 2); *Breastfeeding and complimentary feeding practices* including a 24-hour recall without quantity measures, where the mothers answered to what foods and liquids their child consumed for the past 24 hours (Table 3); and *Anthropometric measurements* of the child, for field workers to fill out at the time of the interview (Appendix 1).

#### 3.4.2. Translation and pilot testing

After arriving in Nepal, the questionnaire was completed with help from local field workers. This to ensure that the questionnaire was adapted to the local, cultural setting. The questionnaire was translated from English to Nepali and translated back to English to ensure the meaning of the questions were intact. After questionnaires were filled out, the 24-hour recall and Nepali calendar dates were translated from Nepali to English with help from the NGO's employees. The translation happened immediately after mothers' group, home visits or outreach camp, making it easy to clarify any possible misunderstandings or misinterpretations.

The questionnaire was pilot tested on mothers within the target group criteria, both by fieldworkers not affiliated with the NGO who were trained in collecting data for similar health studies, and by the fieldworkers whom eventually collected the data for this study. Minor alterations were made to language and layout after both rounds of pilots.

#### 3.4.3. Data collection

The trained fieldworkers collecting the data were all hired employees of the NGO and local inhabitants of Thimi, with Nepali as their native tongue. The training sessions for data collection took place at the NGO's clinic in Bode. The training was divided into two sessions. First the questionnaire was explained and then the fieldworkers practiced by asking each other, leaving time at the end of both sessions for questions and feedback. The fieldworkers also got instructions on how to measure the anthropometrics.

#### 3.4.4. Module 1: Background

The variables for module 1 acquired information of the parents living conditions and circumstances. The questions were adopted from IYCF and the DHS program's *Household questionnaire* (Ministry of Health Population et al., 2017; WHO, 2008, 2010a). The variables included in the Background module of the questionnaire are presented in Table 2.

**Table 2.** Background characteristics of the parents and children

<b>Categorical variables</b>	<b>Continuous variables</b>
Marital status	Age, years (mother)
Attended school <sup>a</sup>	Age when married (mother)
Work outside home *	Years of schooling *
Work before child born <sup>a</sup>	Number of children
Took supplements during pregnancy <sup>a</sup>	Children alive
Live with mother-in-law <sup>a</sup>	Children under 5 years
Owens livestock <sup>a</sup>	Number of people in household
Owens a vehicle <sup>a</sup>	Age, months (Child)
Age over/under 6 months (Child)	
Gender (Child)	
Delivered at full term <sup>a</sup>	
Diarrhea past 2 weeks (Child) <sup>a</sup>	
Other disease past 2 weeks (Child) <sup>a</sup>	
Chronic conditions (Child) <sup>a</sup>	

\* Question also asked about father of child. <sup>a</sup> Divided into Yes or No. Marital status, divided into married, separated, divorced; Work outside the home: if no: Work outside home before child was born; Owens a vehicle: if yes alternatives: car; truck; scooter; tractor and/or a bicycle.

#### 3.4.5. Module 2: Breastfeeding and complimentary feeding practices

Ten of the WHO's 15 core and optional indicators for assessing infant and young child feeding practices were used for module 2 of the questionnaire (WHO, 2008, 2010a). Table 3 presents the questions in module 2, and Table 4 presents the definitions of IYCF core and optional indicators included in this study.



**Table 3.** Breastfeeding and Complementary feeding practices

<b>Variables</b>	<b>Answer alternatives</b>
Has the child ever been breastfed?	Yes/No
Did the child receive the first milk (colostrum)?	Yes/No
Did you give any other food before breastfeeding?	Yes/No If answer yes: specify
How long time after birth did you start breastfeeding this child?	Not breastfed; within the first hour; within the first 6 hours; within the next 6-24 hours; after 24 hours
Do you still breastfeed your child?	Yes/No If answer yes: Did you breastfeed your child yesterday? If answer no: Until what month of the year did you breastfeed your child?
Did the child consume breast milk (from mother or from other woman) by spoon, cup, or bottle yesterday during the day or at night?	Yes/No If answer yes: specify
In the last six months, was the child given a vitamin A dose?	Yes/No
Was the child given any vitamin drops or other medicines as drops yesterday during the day or at night?	Yes/No
Did the child have any of the following liquids:	Plain water; infant formula; juice or juice drinks; clear soup; milk such as powdered, tinned, fresh animal milk, milk tea; yoghurt/curd; any other liquids
Did your child eat like normal yesterday?	Yes/No

A 24-hour recall, without amounts, was also included in the module 2.

**Table 4.** Definitions of IYCF core and optional indicators included in this study

<b>Indicators</b>	<b>Definitions</b>
Early initiation of breastfeeding	The proportion of children born the last 24 months, who were put to the breast within one hour of birth
Exclusive breastfeeding under 6 months	The proportion of infants 0-5 months of age who received nothing but breastmilk during the previous day
Continued breastfeeding at 1 year	The proportion of children 12-15 months of age who received breastmilk the previous day
Introduction of solid, semi-solid or soft foods	The proportion of infants 6-8 months of age who received solid, semi-solid or soft foods during the previous day
Minimum dietary diversity	The proportion of children 6-23 months who received foods from four or more food groups (see Table 5 for list of food groups)
Minimum meal frequency	The proportion of breastfed and non-breastfed children 6–23 months of age who receive solid, semi-solid, or soft foods (including milk feeds for non-breastfed children) the minimum number of times or more
Minimum acceptable diet	The proportion of children 6-23 months of age who received a minimum acceptable diet, apart from breast milk. Here <i>milk-feeds</i> is a variable separate from dietary diversity score, with a minimum score of two for non-breastfed children
Children ever breastfed	The proportion of children born the last 24 months who were ever breastfed
Continued breastfeeding at 2 years	The proportion of children 20-23 months of age who received breastmilk the previous day
Predominant breastfeeding under 6 months	The proportion of infants 0-5 months of age who are predominantly breastfed, meaning only receiving breastmilk and water; water-based drinks or fruit juice

\*The minimum number of times is set to two times if 6-8 months and three times if 9-23 months of age for breastfed children and four times for non-breastfed children. A separate food group for snacks was included for the calculation of this variable. (WHO, 2010a).

Information on what food the children consumed for the past 24 hours was divided into seven food groups defined in the IYCF (WHO, 2010a). According to the IYCF a “meal” includes both meals and snacks, except those snacks of trivial amounts (WHO, 2008). Snacks are not to be confused with snack foods, such as sweets, non-savory biscuits, chips, etc. These are not included in any of the food groups (Table 5), hence not included when calculating meal frequency in the IYCF. After observing how many of the children’s snack meals consisted of such snack foods, in this paper they were included as its own group, for the calculation of meal frequency. This decision was made based on the assumption of it presenting a more accurate calorie consumption for children in this age group for the target group in this study (WHO, 2008).

**Table 5.** Definition of the food groups, including snack foods

<b>Name</b>	<b>Foods</b>
Food group 1	Grains, roots, and tubers
Food group 2	Legumes and nuts
Food group 3	Dairy products
Food group 4	Flesh foods such (meat, fish, and organ meats)
Food group 5	Eggs
Food group 6	Vitamin-A rich fruits and vegetables
Food group 7	Other fruits and vegetables
Snack foods	Biscuits, sweets chips, etc.

#### 3.4.6. Anthropometric Measurements

The children’s weights and recumbent length were measured. The children’s weight was measured on a digital, *Microlife* scale, and the children’s length was measured using a length board manufactured by *Seca* for UNICEF. The child’s weight was recorded using two measurements: first by recording the total weight of the mother holding her child, then by recording the mother’s weight. Further the field worker subtracted the mother’s weight using a calculator on site. The children’s weight was registered to the nearest 100 grams, and 200 grams

was subtracted for clothes weight. Recumbent length of the child was measured from the nearest 0.1 cm. Anthropometric measurements were assessed by the trained field workers. The measurements of weight and length were made on the same day as the questionnaire was answered.

For the children's growth standards, the WHO's reference values were used for calculating gender specific z-scores of the anthropometric indicators: weight-for-age (WAZ); weight-for-height (WHZ); and height-for-age (HAZ). The calculations were made using the computer software program *WHO Anthro, version 3.2.2.* (WHO, 2011). A child was categorized as moderately underweight, wasted, or stunted, if their z-score was  $\leq -2$  and severe if their z-score was  $\leq -3$  (WHO, 2018a).

### 3.5. Data management and Statistical Analysis

For the construction of variables, figures and tables and preformed statistical analysis, the statistical program IBM SPSS Statistics 24 was used (IBM Corp. Armonk, NY).

#### 3.5.1. Descriptive statistics

Descriptive statistics was performed for all variables in the study, including the anthropometric measurements and z-scores, and the ten core and optional indicators included in the study. Continuous variables were presented as mean  $\pm$  standard deviation (SD) for normally distributed data, and as median with the 25th and 75th percentiles (p24-p75) for skewed data, divided into urban, rural, and total study sample. The categorical variables were presented as % [n], with percentage of total- (n=111), urban- (n=64) and rural-(n=47) study sample.

#### 3.5.2. Comparison analysis

To test for significant differences of the independent variable urban/rural, and the dependent variables, two different statistical tests were performed: A Continuity Correction Chi-Square test for the categorical variables, from the core- and optional IYCF indicators, and a Mann-Whitney U test for the continuous, anthropometric z-score values. Non-parametric tests were used, as these tests are better suited for data that is not normally distributed and small samples (Pallant, 2010). The significant p-value was set to  $\leq 0.05$  for both tests.

### 3.5.3. Regression analysis for associations

Multiple, linear regression analysis was performed to explore associations between nutritional status, expressed by the dependent variables WHZ, WAZ and HAZ, and child feeding indicators, as well as background variables. Nutritional status was assessed for associations with the following independent variables: Attended school; Years of schooling; Work outside home; Supplements during pregnancy; Live with mother-in-law; Mother's age; Number of children; Number of people in household; Owns livestock; Owns vehicle; Child's age; Child's gender; Delivery at full term; Diarrhea last two weeks, Diarrhea last two months; Any antenatal check-ups; Number of antenatal checkups; Where was child born; Circumstance of delivery; Child immediately put on chest; Child ever breastfed; Child received colostrum; Prolactal feeds; Early initiation of breastfeeding; Exclusive breastfeeding; Still breastfed; Continued breastfeeding at 1 year; Continued breastfeeding at 2 years; Child received vitamin A supplement in past 6 months; Child introduced to solid, semi-solid, soft foods; Child received minimum dietary diversity; Child received minimum meal frequency; Child received snack. All categorical variables with more than two categories were dichotomized as follows: Years of schooling: 1= primary level (less than six years of schooling), 2= secondary level or higher (more than five years of schooling); Number of children: 1=  $\leq 2$  children, 2=  $> 2$  children. Multiple, linear regression was performed by stepwise backwards selection, conducted manually. Variables with a significant association at 0.2, by simple regression analyses, were included in the preliminary multiple models. Only variables with an association  $< 0.05$  were presented in the final multiple models. Each of the variables from the simple analysis were re-included to check for associations in the final model. Analysis of the residuals was performed to examine the fit of the model, and all residual values not in the range -3 to 3 were excluded.

### 3.6. Ethical considerations

The study was approved by Norwegian Center for Research Data (NSD), and approved by the NGO's board, both at their European location and Nepal. An application was also sent to the Regional Committees for Medical and Health Research Ethics (REK) in Norway prior to the initiation of the study. REK considered the intended information gathered for this study as not sensitive, and a formal approval unnecessary. All mothers received a letter of consent that they either read themselves or that the fieldworker read to them, before they agreed to sign. The letter of consent provided information about the study, that enrollment was voluntary and informed of

their rights to not answer or to withdraw their answers at any time (Appendix 2 and 3). The mothers were all provided an ID number, hence the data is anonymous. The questionnaires were stored in a safe place during the time of analysis and was maculated when analysis was completed.

## 4. Discussion

This chapter will first discuss the strengths and limitations of sampling, data collection, and what may challenge the strength of the study, including validity, generalizability, and possible sources of bias. Secondly, the researcher will discuss aspects of the study results related to immediate and underlying causes of child malnutrition which were not elaborated upon in the research article, including possible sources of bias.

### 4.1. Methodological issues

#### 4.1.1. Study design and sample

This study used a cross-sectional design. Cross-sectional designs are appropriate for observational research, describing characteristics of populations and exploring correlates (Bowling, 2014). As data in cross-sectional designs are collected at one point in time, causality or direction of causality cannot be inferred (Bowling, 2014).

The study population was mothers with children age 0-24 months living in urban and rural areas in the Bhaktapur and Kavrepalanchok districts of east-central Nepal. Data were collected from a specific geographical region of Nepal, and results may therefore be representative for this region only, and might contribute to insight in variations within the urban and rural populations in the country.

For this study, convenience sampling was used. Convenience sampling is an example of a nonprobability sampling method that produces a non-representative sample of the target group with a chance of systematic bias (Gibson, 2005). This sampling method therefore limits the degree in which the findings may be generalizable. However, convenience sampling was a suited method and the most feasible in the circumstance of this study, as there were no public health records available for the researcher to use for a probability sampling method. It also enabled the researcher to gather a sample in an efficient way, which was of the essence considering the short

time frame. Other sampling methods might have been used, such as snowball sampling, that are well suited for areas without available health records (Shaghghi, Bhopal, & Sheikh, 2011).

Although convenience sampling may lead to a less representative sample, measures were taken to strengthen representativeness. This study's data collection was mainly conducted in collaboration with an NGO, and data were primarily gathered through the different programs run by the organization. In addition, some of the participating mothers were recruited outside the NGO's programs, through convenience sampling at locations close to where these programs took place (e.g. at the health clinic located in the same building as the NGO's premises or unscheduled visits to local carpet factories). These mothers may have received a different amount and form of information on feeding practices, child- and maternal health, and this method ensured a more heterogeneous sample of mother-child pairs. This reduced chance of systematic bias, and the sample can be argued to be more representative of the target population.

The sample for this study was 111 mother-child pairs, consisting of two clusters of 64 and 47 pairs from urban and rural areas, respectively. The final sample cluster from rural areas was lower than calculated size, aiming for 53 per cluster. A larger sample strengthens the representativeness of study results.

#### 4.1.2. Data collection and analysis

##### *Questionnaire*

The questionnaire used to collect data in this study is based on the questionnaire in WHO's *Indicators for assessing infant and young child feeding practices* (IYCF) (WHO, 2010a). The questionnaire was developed and has been tested for validity in a comprehensive process over five years (WHO, 2008). Thus, the validity of the results is arguably strong.

Another strength of using the IYCF is the possibility to compare the result from this study with the NDHS and other studies that also used the indicators for collecting and analyzing their findings. The assorted methods of data collection found in literature can make the comparing of data a challenge. Hence, using a globally acknowledged and standardized method, makes the results of the study easier to compare with other, similar studies.

Although the questionnaire is based on standardized assessment methods, minor adjustments were still made for the questionnaire to fit the context of Nepal. Cultural adjustments are

important to prevent the questions from unintendedly offending the person in question. Further, it is important to ensure that the subject understand what she is being asked, to hence answer to the question properly and avoid respondent biases. In the present study, all questions were also evaluated for cultural appropriateness by locals. For example, the question of marital status was rephrased to not be perceived as offensive to the mothers. Food items on the food checklist for the 24-hour recall were adjusted to present foods that fit with Nepali food culture. The questionnaire was translated by people with Nepali as their first language and translated back to English to ensure the meaning of the questions kept their meaning. The question about receiving breastmilk from mother or from other woman with bottle, spoon, or cup, was often misinterpreted by the field workers, and was reformulated in Nepali after the first couple of interviews. Such alterations will strengthen the validity of the questions, for the specific social and cultural context (WHO, 2010a).

After transferring the collected data from the filled-out questionnaires to the computer spreadsheet it became clear that the anthropometric measurement training should have been more thorough. Several of the children's recumbent length was read off from the nearest 0.5 cm instead of the nearest 0.1 cm, leading to measurement bias for the children's nutritional status and possibly masking the actual levels. The data collection setting and circumstance, especially in the rural areas made it impossible for the researcher to correct this at the time of measurement. In the questionnaire the field workers were asked to estimate the weight of the children's clothes. The estimation of weight on clothes, and variation in the amount of clothes the children were wearing is a plausible source of measurement bias. Due to great variety in this estimate the researcher decided to set a standard weight of 0.2 kg/kilograms to be subtracted from the child's weight before calculating z-score. The scales used for measuring the children was not standardized. It was the one available at the NGO clinic, and it was calibrated every day before collection.

#### *Data collection*

The training of the fieldworkers may be a source of bias. The training of the fieldworkers was only over the course of two half-days, and one of the fieldworkers was not present for the part where they practiced the questionnaire on each other. This may have led to interviewer bias, affecting standardization of how the questions were asked (Gibson, 2005). Interviewer bias may



also have been caused by how the field workers' pride as employees of the NGO and their unconscious desire to project the work of the NGO in a good light, hence probing the questions in a way leading to social desirability- and approval bias. The researcher was able to build a good relationship with the fieldworkers and a strong feeling of collaboration and common "ownership" to the project, especially toward the end. The researcher was present for all interviews the first week, to aid the field workers or the mother's questions or any difficulties regarding the questionnaire.

The settings in which data collection were carried out in urban areas were different than those in rural areas and may have caused interviewer bias. The data collected in rural areas were all collected in three days, while the urban data were much more spread out. Additionally, in urban areas the setting was more intimate, either after mother's group or home visits. This allowed for an interview setting where the mother and her child were the sole focus with few distractions. The data collection in the rural areas was in connection with the NGO's outreach camps, in a busy, crowded, and under efficiency-oriented circumstances.

Seasonal variations (like holidays, weather conditions, etc.) affect a person's answers and 24-hour dietary recall (Gibson, 2005). Retrospective dietary assessment methods such as a 24-hour recall may be prone to recall bias and causing misreport of the prevalence of dietary intake (Gibson, 2005). It is, however, the method recommended by the WHO, and that which is used in the IYCF questionnaires. In this study most of the mothers answered that their child ate normally the day before.

#### *Processing of data and statistical analysis*

The Chi-Square- and Mann-Whitney U- tests for differences between urban and rural were made based on the hypothesis of urban-rural differences. The tests were only run between the IYCF indicators, and not the background variables. As it became clear through other similar studies how background factors often are mediating factors to indicator differences, this lack of testing may be a weakness to the study. Multiple, linear regression analysis for associations to undernutrition were performed, however. Through these tests, associations with background variables were found.

## 4.2. Results

### 4.2.1. Immediate causes of malnutrition

#### *Exclusive breastfeeding*

The high rates of exclusive breastfeeding found in this study may be caused by social desirability- and approval bias, where the mothers have a perceived notion on what is the “correct” or “preferred” answer (Gibson, 2005). Further, they may be explained by interviewer bias, such as mentioned above. The sample of infants <6 months in this study was small. Small samples lend themselves less to generalization, and weaken the findings in this age group, especially when comparing the urban and rural areas (Gibson, 2005). With n= 35 across both areas, whereof n=18 and n=17 in urban and rural areas, respectively, no generalization about the <6-month-old infants in the areas can be made. The data might rather give an idea of the trend within the collected sample.

#### *Disease and hygiene practices*

An immediate cause of undernutrition is diarrhea (UNICEF, 1998). The prevalence of children in the present study who had experienced diarrhea in the past two weeks was slightly lower than the national average of 8% (Ministry of Health Population et al., 2017), and considerably lower when comparing to other, more area specific studies from Nepal (Paudel, Pradhan, Wagle, Pahari, & Onta, 2012). Diarrhea is often caused by poor hygiene, poor water quality and inappropriate complimentary feeding (UNICEF, 1998), and is one of the major immediate causes of undernutrition in children (Richard et al., 2013). The lower prevalence of diarrhea found in the present study may in part explain the higher levels of undernutrition found in other, similar studies from Nepal. A possible reason for the low prevalence of diarrhea may be because data for this study were collected primarily after the monsoon season, which is the high season of diarrheal disease (Aryal et al., 2012; Bhavnani, Goldstick, Cevallos, Trueba, & Eisenberg, 2014; Rowland, 1986). Other reasons may be that the children in the rural areas in this study had access to good quality water, and the mothers in the urban areas in this study, were educated on the importance of hygiene, or that the source of water was from a tanker truck, preventing the use of non-treated city water. Information on hygiene practices and nutrition is important in improving child-undernutrition. Additionally, the mothers’ level of education was high in this study, which also may have contributed to a low prevalence in diarrhea.

#### 4.2.2. Underlying causes of malnutrition

##### *Antenatal care*

Across both areas, this study found no statistically significant differences between access to health care services related to ante- and postnatal care. Antenatal care (ANC) and postnatal care (PNC) are important health care services for the prevention of infant and maternal morbidity and mortality (EWEC, 2017). All but one of the mothers in rural areas attended antenatal checkup at least once. The proportions of mothers seeking four or more ANC visits in urban and rural areas in this study was 92.2% and 89.4 %, respectively. These proportions are high compared to findings from NDHS, where 76% and 62% in urban and rural areas attended four or more ANC, respectively (Ministry of Health Population et al., 2017). The high rate of ANC visits is not unexpected, as Nepal introduced governmental initiatives of economic compensation for mothers to a visit health professional a minimum of four times pre-delivery (Pokhrel et al., 2016; WHO, 2015). Findings from NDHS show an impressive increase in mothers seeking ANC in Nepal the past decade, and the latest survey found that 84% of the women had received ANC from a skilled provider for their most recent birth (Ministry of Health Population et al., 2017). Another study from Nepal found that about 80% of the mothers had received antenatal care, but only 49% across both urban and rural areas had been to four or more antenatal visits (Pokhrel et al., 2016). These differences may be explained by some of the rural areas in Nepal being more remote than those in our study, making the challenge of seeking a health professional for those with no care centers in their area. In addition, the data for this study were collected in conjunction with an NGO's postnatal and general health programs.

##### *Postnatal care*

Direct skin contact is an important component to newborn care and is strongly associated with protecting against infant morbidity and mortality (UNICEF, 2016). In this study, 47% of the mothers had their child put immediately on the chest, with 42% and 53% from urban and rural areas, respectively. The results from our study are lower than what is presented in the NDHS, where 65% and 60% of newborns in urban and rural areas, respectively, were put directly on their mother's chest (Ministry of Health Population et al., 2017). If the child being immediately put on the mother's chest is considered an indicator for available health services, this may indicate that access to optimal, newborn care for mothers participating in this study is inadequate.

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Article

# Nutritional status and infant and young child feeding practices in urban and rural areas of east-central Nepal

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**Background:** Poor feeding practices lead to child malnutrition and consequently impaired physical and cognitive development. This study aims to describe nutritional status, feeding practices, and access to health care in children 0–24 months, in urban and rural Nepal, and to explore predictors for nutritional status. **Methods:** A cross-sectional study was conducted among 111 mother-child pairs. Data were collected using the World Health Organization's indicators for infant and young child feeding practices, and the children's anthropometrics were measured. **Results:** We found undernutrition of medium public health significance among the children across urban and rural areas. The rate of exclusive breastfeeding was 80%, but only 43% received a minimum acceptable diet, and snack foods were consumed by 59% of children in the past 24 hours. No significant differences were found between children in urban and rural areas with respect to access to health care, feeding practices or nutritional status. Stunting was substantially higher among children in rural areas. Maternal school level; number of children; number of antenatal visits; and number of children were statistically significant predictors of undernutrition. **Conclusion:** This study indicates that suboptimal feeding practices and undernutrition exist across urban and rural areas. Early childhood nutritional interventions are necessary to prevent child undernutrition.

**Keywords:** infant and young child feeding; breastfeeding; complementary feeding; undernutrition; nutritional status; antenatal care; postnatal care; urban and rural; Nepal

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## 1. Introduction

Adequate nutrition is crucial for a child's development, and malnutrition is a leading cause of childhood morbidity and mortality [1–3]. Malnutrition in terms of undernourishment compromises a child's immune-function, lowering its disease tolerance and resilience [4], and predispose the child to the development of chronic and non-communicable diseases (NCDs) later in life [5]. The impact undernourishment has on cognitive and physical development may pass through generations, depriving people of the opportunity to reach their full potential and ability to step out of poverty [5,6]. The first 1000 days after conception, is considered the "critical window" for a child's physical and mental development [1,7,8]. Recovering lost potential caused by malnourishment, proves difficult after the child has reached two years old [5,7,9,10]. Exclusive breastfeeding for the first six months and timely introduction of complementary food are found to be highly beneficial for a child's health [11]. Inappropriate breastfeeding and complementary feeding practices are considered to be the main causes of undernutrition, along with disease such as diarrheal disease, which is often caused by poor hygiene [11]. An estimate of 823 000-child deaths could be prevented with appropriate breastfeeding practices [10]. Improving child-nutrition is a crucial step in improving global nutrition, and to attain knowledge about child feeding practices through population-based surveys, the World Health Organization (WHO) has developed a set of indicators for assessing infant and young-child feeding practices (IYCF). Many initiatives have been implemented to tackle the complex and global burden of malnutrition, resulting in a substantial reduction in



undernourishment over the past decades [4]. These include the Sustainable Development Goals, (SDGs), where four out of 17 are nutrition specific; the 2012 World Health Assembly's approved implementation plan of six, global targets, aiming to improve infant, young child, and maternal nutrition [12]; and in 2014 the United Nations (UN) declared 2016-2025 as *the decade of action on nutrition* [13]. However, world hunger remains an eminent problem [4], and maternal and child undernutrition still account for 11% of the global burden of disease [12,14]. Globally, over half of the children under the age of five who are stunted live in Asia [15] and in 2016 more than 61 million and 27 million children under the age of five in Southern Asia were stunted and wasted, respectively [15].

In low-income countries, children living in urban areas are less likely to be undernourished than those living in rural areas, due to favorable socioeconomic conditions [16]. Advantages such as better access to health-care facilities, a diversified job market and education in urban areas [17] contribute to the rapid urbanization of low- and middle- income countries (LMIC) [6]. This trend of urbanization and economic growth in LMIC pose a new set of challenges, including nutrition transition, where the consumption of commercial processed foods and snacks increases drastically, contributing to child malnutrition [18-21].

Nepal is one of the poorest countries in the world, with several nutrition-related health challenges [22]. According to the Nepali Demographic and Health Survey (NDHS) from 2016, 36% of children under the age of five are stunted; 10% are wasted and 27% are underweight, with higher prevalence in rural areas for all three indicators [23]. Over the past two decades there has been a parallel development of improved breastfeeding practices and a significant reduction of undernutrition in Nepal [23,24]. There has however been a decline in exclusively breastfed children in the past five years, and barely over one-third of the children received a minimum acceptable diet. Additionally, the unevenly distributed burden of undernutrition in rural versus urban areas persist [23,25].

In this study we describe nutritional status, breastfeeding practices, complementary feeding, and access to health care in children 0-24 months of age in urban and rural areas of Nepal. Further we explore predictors for nutritional status among the children. To our knowledge there are no recent studies addressing such wide range of variables linked to infant and young child feeding practices in children 0-24 months and which compare urban and rural areas in Nepal.

## 2. Materials and Methods

A cross-sectional study was conducted from September to November 2017 in the districts of Bhaktapur and of Kavrepalanchok in east-central Nepal. The target group of the study was mothers with children 0-24 months of age, from urban or rural areas. Children who were born severely premature were excluded from the study. Participants were recruited through convenience sampling at postnatal health care- (PNC) and outreach camp- programs of a non-governmental organization (NGO) located in the district of Bhaktapur [26]. Additionally, some mothers in the urban areas, were recruited through unscheduled visits to local carpet factories. Sample size was calculated using the Epi Info software program *StatCalc* [27]. Calculations were made using a statistical power of 80%, a 5% margin of error and two clusters (urban and rural), resulting in a total sample size of 106 and a cluster size of 53. In this study a total of 111 mother-child pairs were recruited, 67 from one urban and 47 from two rural areas.

The data were collected using a structured questionnaire, consisting of three modules: module 1 consisting of background characteristics, ante- and postnatal care; module 2 consisting of IYCF practices [28], including a 24-hour dietary recall without quantity measures answered by the mother on behalf of her child; and module 3 addressing anthropometric measures. The questionnaire was administered by interview in Nepali by trained fieldworkers. The questionnaire was developed based on the WHO's *Indicators for assessing infant and young child feeding practices* [28,29] and the Demographic and Health Surveys (DHS) program's *Household questionnaire* [23]. Ten of the WHO's 15 core and optional indicators for IYCF were used for module 2 of the questionnaire, which were: Early initiation of breastfeeding;

Exclusive breastfeeding under 6 months; Continued breastfeeding at 1 year; Introduction to solid, semi-solid or soft foods; Minimum dietary diversity (MDD); Minimum Meal frequency (MMF); Minimum acceptable diet (MAD); Children ever breastfed; Continued breastfeeding at 2 years; Predominant breastfeeding under 6 months [28,29].

Anthropometric measurements were assessed using a *Microlife* digital platform scale for the child's weight, and a UNICEF *Seca* length board for the child's recumbent length. The child's weight was registered to the nearest 100 grams, and 200 grams was subtracted for clothes weight. Recumbent length of the child was measured from the nearest 0.1 cm. Anthropometric measurements were assessed by the trained field workers.

Gender and age specific z-scores of the anthropometric indicators weight-for-age (WAZ); weight-for-height (WHZ); and height-for-age (HAZ), also known as underweight, wasting and stunting, were calculated using *WHO Anthro, version 3.2.2*. [30]. A child was categorized as moderately underweight, wasted, or stunted if their z-score was  $\leq -2$ , and severe if their z-score was  $\leq -3$  [31].

Data were analyzed using IBM SPSS version 24 (IBM Corp. Armonk, NY). Continuous variables were presented as mean  $\pm$  standard deviation (SD) for normally distributed data, and as medians and 25 and 75 percentiles (p25-p75) for skewed data. The categorical variables are presented as percentage of total [n]. Differences between the rural and urban areas were tested with a Continuity Correction Chi-Square test for the categorical data, from the core- and optional IYCF indicators, and a Mann-Whitney U test for the continuous anthropometric z-score values, with a significant p-value set to  $\leq 0.05$ .

Multiple, linear regression analysis was performed to explore associations between nutritional status, expressed by the dependent variables WHZ, WAZ and HAZ, and child feeding indicators, as well as background variables. Nutritional status was assessed for associations with the following independent variables: Attended school; Years of schooling; Work outside home; Supplements during pregnancy; Live with mother-in-law; Mother's age; Number of children; Number of people in household; Owns livestock; Owns vehicle; Child's age; Child's gender; Delivery at full term; Diarrhea last two weeks, Diarrhea last two months; Any antenatal check-ups; Number of antenatal checkups; Where was child born; Circumstance of delivery; Child immediately put on chest; Child ever breastfed; Child received colostrum; Prolactal feeds; Early initiation of breastfeeding; Exclusive breastfeeding; Still breastfed; Continued breastfeeding at 1 year; Continued breastfeeding at 2 years; Child received vitamin A supplement in past 6 months; Child introduced to solid, or semi-solid, soft foods; Child received minimum dietary diversity; Child received minimum meal frequency; Child received snack. Variables with a significant association at 0.2, by simple regression analyses, were included in the preliminary multiple models. Stepwise backwards selection was conducted manually, and only variables with an association  $<0.05$  were presented in the final multiple models. Each of the variables from the simple analysis were re-included to check for associations in the final model. Analysis of the residuals was performed to examine the fit of the model.

The study was registered with the Norwegian Center for Research Data (NSD). Additionally, all mothers who were recruited signed a consent letter for written consent of participation before being interviewed. The data were anonymized, and the signed letters of consent were maculated when data analysis was completed. The study was also approved by the collaborator NGO's board in Nepal.

### 3. Results

#### 3.1. Background characteristics

Background characteristics of the parents from rural and urban areas and across both areas are presented in Table 1. The mean age of the mothers across both areas was 27 years. A total of 99% of the mothers were married, and the mean age when married was 21 years. Across both areas 87% of the mothers had attended school, with a median duration of 8 years. The father attended school on average one year

longer than the mothers. The mothers had a median of 1 child under 5 years of age, and 98% of the mothers took supplements, primarily iron and calcium. There were few differences in background characteristics between rural and urban areas. The number of both mothers and fathers working outside the home was substantially higher in the urban areas (27% and 87%) than in the rural areas (11% and 68%). Over half of the mothers in the rural areas lived with their mother-in-law, compared to the urban areas (31%). The number of people owning livestock was higher in the rural (76%) than urban (18%) areas, and owning a vehicle was more common in the urban areas.

**Table 1.** Background characteristics of parents residing in rural and urban areas of east-central Nepal (n=111)

	Urban (n= 64)	Rural (n= 47)	Total (n= 111)
<b>Mother</b>			
Age, years	28.5± 4.7	25.3± 4.3	27.1± 4.8
Marital status			
Married	98.4 [63]	100.0 [47]	99.1 [110]
Separated	1.6 [1]	0 [0]	0.9 [1]
Age when married	21.0 (19-25)	20.0 (18-22)	21.0 (18-23)
Attended school	87.5 [56]	87.2 [41]	87.4 [97]
Years of schooling	7.5 (4-10)	9.0 (4-10)	8.0 (4-10)
Work outside home	26.6 [17]	10.6 [5]	19.8 [22]
Work before child born	28.1 [18]	12.8 [6]	21.6 [24]
Number of children	1.5 (1-2)	2.0 (1-2)	2.0 (1-2)
Children alive	1.0 (1-2)	2.0 (1-2)	2.0 (1-2)
Children under 5 years	1.0 (1-1)	1.0 (1-1)	1.0 (1-1)
Took supplements during pregnancy	96.9 [62]	100 [47]	98.2 [109]
Live with mother-in-law	31.3 [20]	53.2 [25]	40.5 [45]
<b>Father</b>			
Years of schooling	9.0 (7-12)	10.0 (8-12)	10.0 (7-12)
Work outside home	87.5 [56]	68.1 [32]	79.3 [88]
<b>Socioeconomic indicators</b>			
Number of people in household	4.0 (3-5)	5.0 (4-6)	4.0 (3-6)
Owens livestock	18.8 [12]	76.6 [36]	43.2 [48]
Owens a vehicle	48.4 [31]	29.8 [14]	40.5 [45]

Values are presented as mean ± SD, median (p25-p75), and % [n]. Six missing from rural Years of school attendance; nine missing from urban Years of school attendance; one missing from urban Work before child, n= 47; four missing from rural Work before child, n= 42; two missing from urban Took supplements during pregnancy; one missing from urban father Work outside home; two missing from rural Owns a vehicle.

Background characteristics of the children from rural and urban areas, and across both areas are presented in Table 2. The median age of the children across both areas was 8 months, whereof one third were infants under <6 months of age. The gender distribution was 60% to 40%, male to female, respectively. A total of 7% of the children had suffered from diarrhea in the past two weeks and about 20% had experienced other diseases in the past two weeks. None of the children suffered from any chronic diseases. Except for a substantial difference in urban (27%) and rural (13%) children suffering from other disease past 2 weeks, there were no substantial differences in child characteristics between the two areas.

**Table 2.** Background characteristics of children residing in rural and urban areas of east-central Nepal (n=111)

	Urban (n=64)	Rural (n=47)	Total (n=111)
<b>Child</b>			
Age, months	9.0 (4.3-16)	8.0 (3-15)	8.0 (4-15)
<6 months	28.1 [18]	36.2 [17]	31.5 [35]
≥6 months	71.9 [46]	63.8 [30]	68.5 [76]
Female	40.6 [26]	38.3 [18]	39.6 [44]
Delivered at full term	98.4 [63]	97.9 [46]	98.2 [109]
Diarrhea past 2 weeks	7.8 [5]	6.4 [3]	7.2 [8]
Other disease past 2 weeks	26.6 [17]	12.8 [6]	20.7 [23]
Chronic conditions	0 [0]	0 [0]	0 [0]

Values are presented as mean ± SD, median (p25-p75), and % [n].

### 3.2. Anthropometric measurements

The nutritional status of the children is presented in Table 3. In total 12.6% of the children were underweight, 9.0% were wasted and 20.7% stunted, whereof 4.5% severely underweight, 1.8% severely wasted, and 9.0% severely stunted, across the rural and urban areas. The prevalence of all three conditions was higher in the rural areas. For stunting the difference between rural- (27.7%) and urban- (15.6%) areas was substantial, however not statistically significant. None of the children from urban areas were moderately underweight, compared to 10.6% moderately underweight children in rural areas.

**Table 3.** Anthropometric measurements of children residing in rural and urban areas of east-central Nepal (n=111)

	Urban (n= 64)	Rural (n= 47)	P	Total (n= 111)
Underweight	-0.5 ± 1.1	-0.8 ± 1.3	0.118	-0.6 ± 1.2
Moderate, -3 and ≤ -2 WAZ	9.4 [6]	6.4 [3]		8.1 [9]
Severe, ≤ -3 WAZ	0 [0]	10.6 [5]		4.5 [5]
Total, ≤ -2 WAZ	9.4 [6]	17.0 [8]		12.6 [14]
Wasted	-0.05 ± 1.8	-0.3 ± 1.3	0.880	-0.13 ± 1.6
Moderate, -3 and ≤ -2 WHZ	6.3 [4]	8.5 [4]		7.2 [8]
Severe, ≤ -3 WHZ	1.6 [1]	2.1 [1]		1.8 [2]
Total, ≤ -2 WHZ	7.8 [5]	10.6 [5]		9.0 [10]
Stunted	-0.7 ± 1.8	-1.0 ± 1.5	0.092	-0.8 ± 1.7
Moderate, -3 and ≤ -2 HAZ	6.3 [4]	19.1 [9]		11.7 [13]
Severe, ≤ -3 HAZ	9.4 [6]	8.5 [4]		9.0 [10]
Total, ≤ -2 HAZ	15.6 [10]	27.7 [13]		20.7 [23]

Values are presented as mean ± SD, and % [n]. Three children missing from urban WAZ and HAZ (n= 61); two children missing from rural WAZ and HAZ (n= 45). Differences between groups are measured with a Mann-Whitney U test.

### 3.3. Antenatal and postnatal care

Antenatal and postnatal care is presented in Table 4. Nearly all mothers saw a health professional for antenatal check-up(s) and the median number of check-ups was seven times, across both areas. A total of 60% of the mothers went to a government hospital for check-up, 28% went to a primary health care center, and 12% went to a private health care center. About 70% of the children were born in a government hospital, and 10% were born at home without help from a health professional. Almost half of the mothers had their child put on their chest immediately after birth. The greatest differences between the areas were

location of check-ups and delivery. In the urban areas it was more common to visit the government hospital for check-ups and for delivery, and in rural areas visiting primary health care centers or health posts was more common. Caesarean section was more common in urban (36%) areas than rural (21%), and having their child put on their chest immediately after birth was more common in the rural (53%) than the urban areas (42%).

**Table 4.** Antenatal and postnatal care in rural and urban areas of east-central Nepal (n= 111)

	Urban (n=64)	Rural (n= 47)	Total (n=111)
Antenatal check-up	100.0 [64]	97.9 [46]	99.1 [110]
Number of check-ups	9.0 (6-10)	6.0 (5-9)	7.0 (5-9)
Where check-up			
Government hospital	75.0 [48]	38.3 [18]	59.9 [66]
Primary health care center	14.1 [9]	46.8 [22]	27.9 [31]
Private health care center	9.4 [6]	14.9 [7]	11.7 [13]
Where was the child born			
At home without help from health professional	6.3 [4]	14.9 [7]	9.9 [11]
At home with help from health professional	1.6 [1]	6.4 [3]	3.6 [4]
Government hospital	82.8 [53]	51.1 [24]	69.4 [77]
Health post	3.1 [2]	17.0 [8]	9.0 [10]
Private hospital	6.3 [4]	8.5 [4]	7.2 [8]
Other	0 [0]	2.1 [1]	0.9 [1]
Circumstance of delivery			
Normal	64.1 [41]	76.6 [36]	69.4 [77]
Caesarean section	35.9 [23]	21.3 [10]	29.7 [33]
Other	0 [0]	2.1 [1]	0.9 [1]
Child immediately put on chest			
Yes	42.2 [27]	53.2 [25]	46.8 [52]
No	54.7 [35]	38.3 [18]	47.7 [53]
Do not know	1.6 [1]	6.5 [4]	4.5 [5]

Values are presented as mean  $\pm$  SD, median (p25-p75), and % [n]. One missing from urban where check-up; two missing from urban Child immediately put on chest; four missing from rural Child immediately put on chest.

### 3.4. Breastfeeding and complementary feeding practices

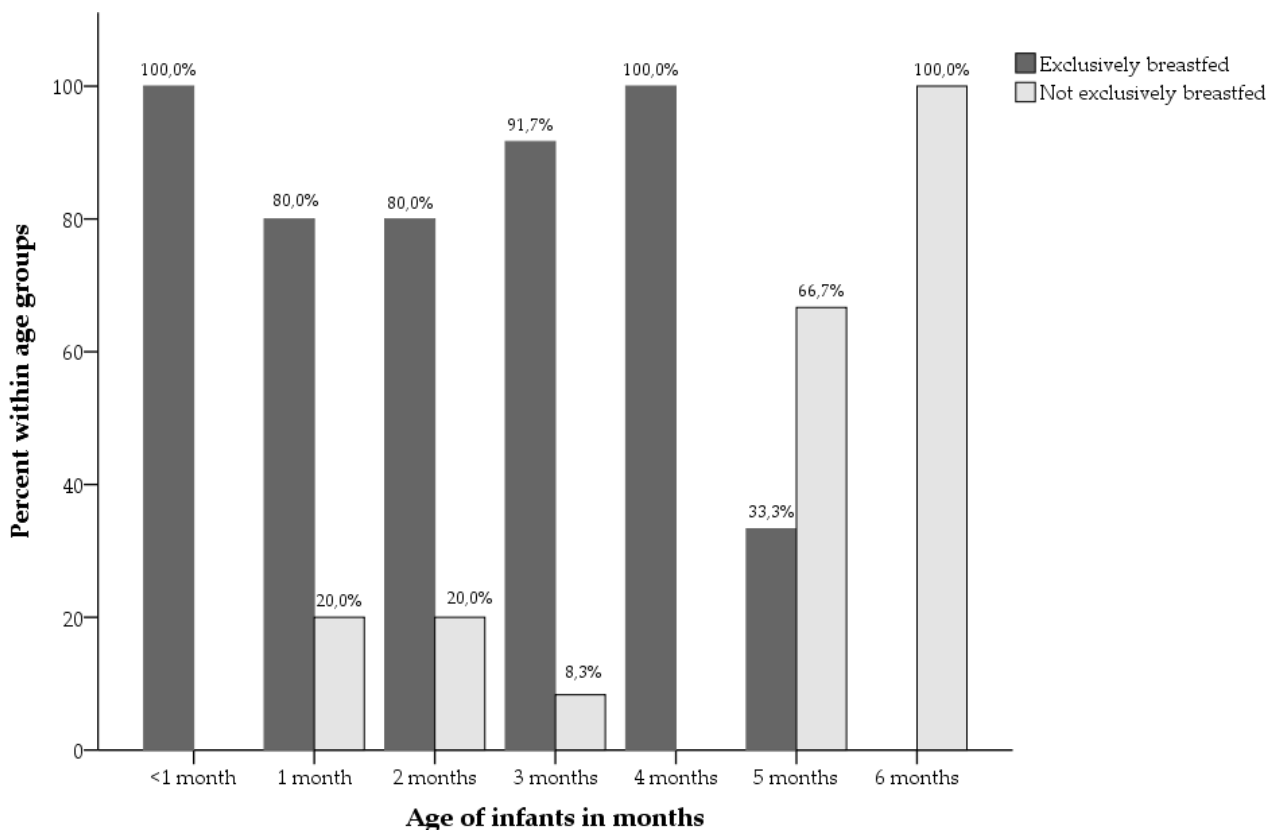
Breastfeeding practices in rural and urban areas and across both areas are presented in Table 5. Across both areas, all except one child, had ever been breastfed, and all except three children had received colostrum. About 12% had received prelacteal feeds, and 71% initiated breastfeeding within one hour after delivery. Among the infants under six months of age, 80% were exclusively breastfed, and one child in the same age group was predominantly breastfed. A total of 93% of the mothers continued breastfeeding until the child reached one year, and 79% of the mothers continued breastfeeding until the child reached two years. The findings were similar in both rural and urban areas, and there were no significant differences in breastfeeding practices between the two areas. More children in the urban- than the rural areas had received a vitamin A supplement dose in the past six months.

**Table 5.** Breastfeeding practices in rural and urban areas of east-central Nepal (n= 111)

	Urban (n=64)	Rural (n= 47)	<i>p</i>	Total (n= 111)
Child ever breastfed	100.0 [64]	97.9 [46]		99.1 [110]
Received colostrum	96.9 [62]	97.9 [46]		97.3 [108]
Prelacteal feeds	12.5 [8]	10.6 [5]	0.95	11.7 [13]
Initiation of breastfeeding				
Within one hour	67.2 [43]	76.6 [36]	0.39	71.2 [79]
Within the first 6 hours	21.9 [14]	14.9 [7]		18.9 [21]
Within the next 6-24 hours	4.7 [3]	0 [0]		2.7 [3]
After 24 hours	6.3 [4]	8.5 [4]		7.2 [8]
Exclusive breastfeeding (n=35*)	88.9 [16]	70.6 [12]	1.00	80.0* [28]
Predominant breastfeeding (n=35*)	0 [0]	5.9 [1]	0.88	2.9* [1]
Still breastfeeding	96.9 [62]	95.7 [45]	1.00	96.4 [107]
Breastfed yesterday	93.8 [60]	85.1 [40]	1.00	90.1 [100]
Continued breastfeeding at 1 year (n=14)	90.0 [9]	100.0 [4]	0.55	92.9 [13]
Continued breastfeeding at 2 years(n=14)	88.9 [8]	100.0 [3]	0.46	78.6 [11]
Child given vitamin A last six months	46.9 [30]	38.3 [18]	0.44	43.2 [48]

Presented as % [n]. One missing from urban Received colostrum; two missing from urban prelacteal feed; one missing from urban Still breastfeeding; five missing from rural Still breastfeeding; one missing from urban breastfed yesterday; five missing from rural breastfed yesterday; one missing from urban Child given vitamin A. Differences between groups are measured with a Continuity Correction Chi-Square test. \*Children <6 months of age (n=35)

Figure 1 shows the distribution of infants from zero to six months of age, who within their age group are exclusively breastfed or not. All infants aged less than one month of age and four months of age were exclusively breastfed, 80% of the infants one- and two months of age were exclusively breastfed, 33% of the infants five months of age were exclusively breastfed, and none of the infants six months of age were exclusively breastfed.



**Figure 1.** Percentage of infants ≤6 months, who are exclusively breastfed or not, within their age group (n=37)

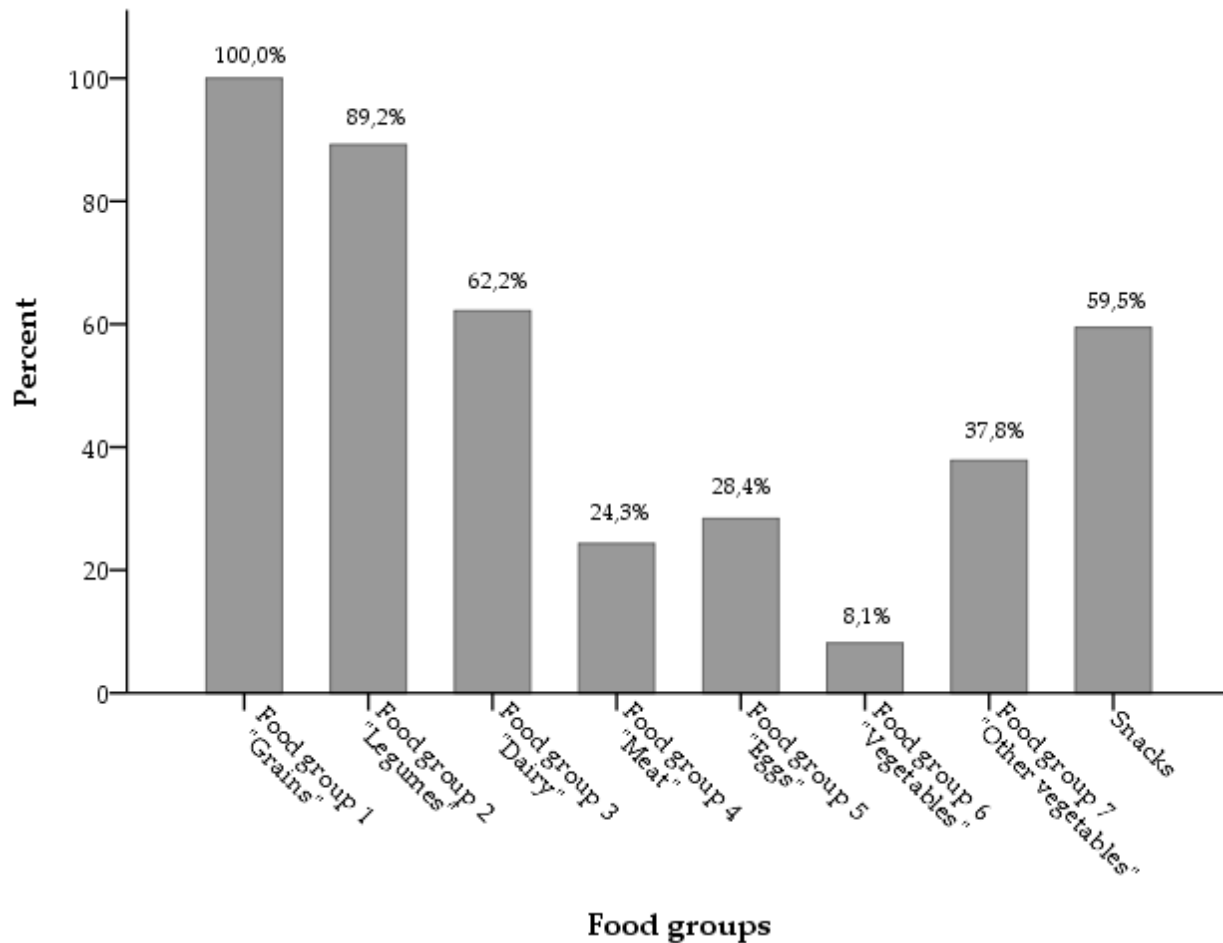
Table 6 shows complementary feeding practices. Across both areas, 96% of the children six to eight months of age had been introduced to solid, semi-solid and soft foods, and over 80% received the minimum meal frequency. Less than half of the breastfed children in the age group six to 23 months consumed the minimum dietary diversity, and 43% of the children had received the minimum acceptable diet. Overall, the values were about 10% lower in the rural areas than in the urban areas, except the minimum dietary diversity in non-breastfed children. The group of non-breastfed children was however very small. Almost 60% of the children ≥6 months of age had received snack foods, such as biscuits and sweets. There were no statistically significant differences in feeding practices between the urban and rural areas.

**Table 6.** Complementary feeding practices in rural and urban areas of east-central Nepal

	Urban	Rural	<i>p</i>	Total
Introduced to solid, semi-solid, soft foods, (n=23)	100.0 [11]	91.7 [11]	1.000	95.7 [22]
Minimum dietary diversity, (n=76)			0.585	
Breastfed children	50.0 [21]	41.7 [10]		47.0 [31]
Non-breastfed children	66.7 [2]	100.0 [1]		75.0 [3]
Minimum meal frequency, (n=76)	89.1 [41]	76.7 [23]	0.117	84.2 [64]
Minimum acceptable diet, (n=76)	47.8 [22]	36.7 [11]	0.299	43.4 [33]
Ate snack foods yesterday (n=76)	58.7 [27]	56.7 [17]	0.828	58.7 [44]

Values are presented as % [n]. The age range for Introduced to solid, semi-solid, soft foods is 6-8 months; the age range for Minimum dietary diversity, Minimum meal frequency and Minimum acceptable diet is 6-23 months. Differences between groups are measured with a Continuity Correction Chi-Square test.

Figure 2 shows the percentage of children  $\geq 6$  months of age, introduced to soft, semi-soft and solid foods, who consumed foods from the different food groups, including snacks, in the past 24 hours. Foods consumed by the most children are in the food groups one and two with grains; roots; tubers and legumes; nuts. Only 8% of the children consumed vitamin A rich fruits and vegetables, 24% had flesh foods such as fish or meat, and 60% of the children had a snack such as biscuits, sweets, or chips in the past 24 hours.



**Figure 2.** Percentage of children  $\geq 6$  months of age, introduced to soft, semi-soft and solid foods, who consumed foods from the different food groups, including snack foods, in the past 24-hrs (n=74). Food group 1: Grains, roots, and tubers; Food group 2: Legumes and nuts; Food group 3: Dairy products; Food group 4: Flesh foods: meat, fish, poultry, and liver/organ meats; Food group 5: Eggs; Food group 6: vitamin-A rich fruits and vegetables; Food group 7: Other fruits and vegetables; Snacks: Biscuits, sweets, chips, etc.

Table 7 show predictors for nutritional status expressed by WAZ, WHZ and HAZ, also known as underweight, wasting and stunting, in multiple linear regression models. Underweight (WAZ) was significantly and positively associated with school level of the mothers, number of children and antenatal checkups, showing adjusted coefficients (95% CI) of 0.60 (0.14, 1.05), 1.23 (0.42, 2.04) and 0.11 (0.03, 0.18) respectively. These three predictors explained 17% of the variance in WAZ. Wasting (WHZ), was significantly associated with number of children, as the only explanatory variable, showing an unadjusted coefficient (95% CI) of 1.99 (1.03, 2.95). Number of children explained 14% of the variance in WHZ.



Stunting (HAZ), was significantly and positively associated with school level of the mother and number of antenatal checkups, showing adjusted coefficients (95% CI) of 0.71 (0.08, 1.34) and 0.12 (0.01, 0.22), respectively. The child's age was negatively associated with HAZ, showing an adjusted coefficient (95% CI) of -0.07 (-0.12, 0.03). These three predictors explained 16.3% of the variance in HAZ.

**Table 7.** Predictors for WAZ, WHZ, HAZ in multiple regression models (n=111)

Variables	Unadjusted coefficients 95% CI (lower, upper) <sup>a</sup>	<i>p</i>	Adjusted coefficients 95% CI (lower, upper) <sup>b</sup>	<i>p</i>	Standard beta <sup>c</sup>
<i>Constant WAZ</i>			-3.69 (-5.06, -2.32)	0.000	
School level	0.44 (-0.02, 0.90)	0.060	0.60 (0.14, 1.05)	0.010	0.24
Number of children	0.93 (0.12, 1.75)	0.026	1.23 (0.42, 2.04)	0.003	0.41
Number of antenatal check-ups*	0.12 (0.04, 0.20)	0.003	0.11 (0.03, 0.18)	0.005	0.04
R <sup>2</sup> <sup>d</sup>				0.17	
<i>Constant WHZ</i>	-2.35 (-3.42, -1.29)	0.000	-	-	
Number of children	1.99 (1.03, 2.95)	0.000	-	-	0.37
R <sup>2</sup> <sup>d</sup>				0.14	
<i>Constant HAZ</i>			-2.07 (-3.41, -0.72)	0.003	
School level	0.72 (0.06, 1.39)	0.033	0.71 (0.08, 1.34)	0.027	0.20
Child's age*	-0.07 (-0.12, -0.02)	0.004	-0.07 (-0.12, -0.03)	0.003	-0.28
Number of antenatal check-ups*	0.13 (0.02, 0.25)	0.020	0.12 (0.01, 0.22)	0.036	0.19
R <sup>2</sup> <sup>d</sup>				0.16	

Dependent variables: WAZ, WHZ and HAZ. <sup>a</sup> Unadjusted effect from simple regression. <sup>b</sup> Adjusted effect for variables included in multiple regression analysis. Categories for dichotomous variables: School level ≤5th grade=1, ≥6th grade=2; Number of children ≤2= 1, ≥3= 2. \* Continuous, independent variables. One person was excluded from the WHZ constant due to a residual value >3.

#### 4. Discussion

The present study found that undernutrition among the Nepalese children was of medium public health significance, according to the WHO's classifications [32], with 12.6%, 9.0% and 20.7% being underweight, wasted and stunted, respectively. Further, breastfeeding practices and timely introduction to complementary foods were satisfactory, with 80% of the infants <6 months being exclusively breastfed, 71% of the mothers initiating breastfeeding within one hour after delivery, and 96% of the infants between 6-8 months having been introduced to solid, semi-solid or soft foods. However, poor complementary feeding practices were found, with less than half of the children receiving the minimum dietary diversity, and only 43% receiving a minimum acceptable diet. Additionally, as many as 59% of children ≥6 months consumed snack foods such as sweet biscuits, chocolates, and chips in the past 24 hours. No significant differences were found between children in urban and rural areas with respect to nutritional status or feeding practices, although a substantial difference was found in stunting between urban and rural areas. Access to health care in terms of frequency of antenatal visits, did not differ between urban and rural areas, but a larger proportion of urban women had access through government hospitals.

Differences in levels of undernutrition between urban and rural areas are prevalent in low- and middle- income countries (LMICs) [33], and persistent in the data presented in the NDHS reports [23,24]. In the current study, the public health significance-levels of undernutrition were low for underweight children in urban areas (9.4%), and medium (17.0%) in rural areas, according to the WHO's classification of malnutrition [31]. The level of wasting was medium (7.8%) in urban areas and high (10.6%) in the rural areas; and the level of stunting was low (15.6%) in urban areas and medium (27.7%) in the rural areas, by WHO measures [31]. Although differences were not statistically significant, there were differences in classification levels related to public health significance. The tendency of higher levels of stunting among children in rural areas is addressed in several other studies from Nepal, and other LMICs [34-37]. Undernutrition in terms of stunting, wasting and underweight was found to be lower in this study than findings from the NDHS from 2016 [23]. Also, the Nepal Multiple Indicator Cluster Survey (MICS) from 2014 found higher levels of stunting, wasting and underweight, showing prevalence of 30%, 11% and 37%, respectively [38]. The lower levels of undernutrition found in the present study may be due to the different age span among the participating children, where those 0-59 months were used in the MICS [38] and the NDHS [23,24], compared to those 24 months in this study. This is further emphasized by a study analyzing data from the NDHS from 2011, finding that levels of stunting in the age group 0-23 months was 14 percent-points lower than in the age group 0-59 months [39]. Additionally, as one third of the children in the present study were <6 months and had not yet been introduced to complementary foods. Their potential risk of developing undernourishment would likely increase when introduced to these foods [33,40,41]. The lower levels of undernutrition in the present study may also be explained by the high level of parental education found, being substantially higher than other studies from Nepal [42,43].

Causes of undernutrition presented in the literature are complex, and rarely explained by a sole factor [44-47]. In the present study, the tendency of higher stunting prevalence in rural areas may be explained by differences in available, local incentives to improve maternal and child health. Many of the mothers in the urban setting had been provided information about infant and child feeding from the collaborating NGO, either through one or two post-natal home visits from health personnel, or by attending weekly mothers' groups. In contrast, one of the two outreach camp locations in rural areas was visited for the first time by the same NGO, at the time of data collection for this study. Further, the devastating earthquake in 2015 had a greater impact on this outreach camp location, and it is likely that the families' level of food security was still affected, and more so than in the urban setting.

The protective properties of breastfeeding on child-malnutrition and disease prevention, especially in LMICs, are well-established [10]. In despite of this, only 37% of children <6 months are exclusively breastfed in the world's LMICs [4,10]. The share of exclusively breastfed children <6 months in the present study was substantially higher than findings from national data (66%) [23], as well as other findings from Nepal [47]. One study from the city of Bhaktapur found that 74% were exclusively breastfed at 1 month, but this declined rapidly to only 9% of the children being exclusively breastfed at 6 months [48]. However, the cited study used a different method for data collection than in the present study [48].

The rate of exclusive breastfeeding in the present study was high in both urban and rural areas, and although not significant, higher in urban (89%) than rural (71%) areas. Research from Vietnam [49], China [50] and Nepal [23] indicates that appropriate breastfeeding practices, such as exclusive breastfeeding is more common in rural areas than urban, and children in rural areas are often breastfed longer. A study from Tanzania, on the contrary, found that exclusive breastfeeding and delayed introduction to complementary foods were more common in urban areas than rural [51]. Variations found in feeding practices are influenced by many factors, such as available and accessible resources or services, as well as social influence from cultural practices or advice from family members [5,52]. The lack of significant differences between urban and rural areas found in this study underpins how different feeding practices and nutritional status between these areas are not explained by demographic location alone, and hence needs to be addressed in the combination of other explanatory factors.

Although breastfeeding practices were satisfactory and more than 90% the infants 6-8 months were introduced to complementary foods, only 43% of the children  $\geq 6$  months received the minimum acceptable diet (MAD) in our study. These findings are supported by the literature, illustrating how in the transition to complementary feeding, the child is more inclined to be undernourished [41]. The effects of meal-diversity, frequency and ultimately receiving the minimum acceptable diet, support our findings of prevalence of undernutrition, despite the good breastfeeding practices. A non-significant difference between MAD, minimum acceptable diet (MDD) and meal frequency (MMF) was recorded between urban and rural areas, and in accordance with national data [23]. In a study of children 6-23 months in western Nepal rates of these indicators were substantially lower than what was found in our study, with 35% consuming MDD; 84% consuming MMF, and 33% consuming MAD [43]. This difference may be explained by the high intake of snack foods reported in the present study, and how snack foods were included in the calculation of MMF. In the present study 59% and 57% of the children in urban and rural areas, consumed snack foods in the past 24 hours, respectively. The growing problem of nutrition transition is prevalent in LMICs, and consequently the consumption and availability of commercially processed foods are increasing in LMICs [19]. A recent study found that the number of Nepalese children consuming highly processed foods and snacks is increasing, and that 74% of children 6-23 months of age consumed commercially processed snack food products in the past 24 hours in the Kathmandu-Valley area [18]. Early introduction to- and a high consumption of commercially processed snack foods in a low-income country like Nepal may have an adverse effect on nutritional status, especially if it replaces other more nutrient dense alternatives [18,19]. In the present study, snacks such as sweet biscuits were included as a valid “meal” in the calculations of minimum meal frequency in this study. This decision was based on the observation of many mothers reporting that their child consumed snack foods. Additionally, snacks seem to count as a substantial source of energy for infants and toddlers [28]. This decision has influenced the outcome of reported MMF, hence also MAD.

Maternal school level was positively associated with WAZ-scores (underweight) and HAZ-scores (stunting). This is in accordance with studies from Nepal [53] and studies from other LMIC, finding that especially the mother’s level of education was positively associated with z-scores for nutritional status, and with improved child-care practices related to health and nutrition [11,54]. One study addressing rural-urban disparities in child-nutrition in Bangladesh and Nepal found maternal and paternal education and wealth index to be the strongest determinants of differences in stunting. They found that the variation in these determinants, rather than the demographic location itself, explained the variation in stunting [34]. This is further emphasized by a review of differences in health between urban and rural areas in LMIC [36] and is a valid approach in the present study. Number of antenatal check-ups was also positively associated with WAZ- and HAZ-scores in the presents study. This is in accordance with a study from rural Nepal, where maternal health services and child-undernutrition were addressed [42]. The study concluded that the absence of ANC and PNC were associated with underweight and stunting in children, and poor IYCF [42]. This emphasizes the importance of information on IYCF, nutrition and hygiene practices, provided during ANC and PNC, for the improvement of child-undernutrition. In the present study the proportion of mothers seeking four or more ANC visits was high, compared to national data and other findings from Nepal [23,42]. The rate of ANC visits has been increasing in Nepal, as a positive effect of the governmental initiative of economic compensation for mothers to a visit health professional a minimum of four times pre-delivery in Nepal [22,42]. The child’s age was negatively associated with stunting, meaning the older children had a higher prevalence of stunting. As reported elsewhere, as a child grows older their energy requirement increases, and so does the amount of time a child may have been undernourished, ultimately leading to chronic undernutrition, namely stunting [47,55,56]. Number of siblings was positively associated with WAZ- and WHZ-scores (wasting) in this study, indicating that an increased number of siblings had a protective effect on undernutrition. Studies finding a similar association was not found, but rather the opposite association is prevalent [57-59].

Convenience sampling was used for this study. This is a method producing non-randomized samples, not representative for the target group at large, and with a chance of systematic bias [26]. There were no public health records available to use for a probability sampling method, hence convenience sampling was the best suited sampling method under the circumstance of this study. This method also allowed to collect data from mothers not registered in public health records, and in more remote areas where a randomized recruitment method may be difficult to arrange. Although the sample was collected through convenience sampling and may not be representative for the entire population of mothers with children 0-24 months in Nepal, the sample may be representative for the groups in these areas of Nepal, contributing to the need of area specific, and disaggregated health data. The questionnaire was based on the globally acknowledged and standardized assessment methods of WHO's IYCF and DHS questionnaires [23,28], which arguably makes the validity of the results strong, and the results of the study easier to compare to other, similar studies using these methods. The prevalence of exclusively breastfed is based on the IYCF assessment method, using a 24-hour recall. Retrospective dietary assessment methods such as a 24-hour recall may be prone to recall bias and causing misreport of the prevalence if dietary intake [26]. The high rates of exclusively breastfeeding may also be a result of desirability- and approval bias [26]. The sample cluster for rural areas was lower than calculated as minimum for sample size. This will affect the level of generalizability of the findings in this study.

## 5. Conclusions

The level of undernutrition among the Nepalese children was of medium public health significance across urban and rural areas, with a substantially higher level of stunting in rural areas. The percentage of children who were exclusively breastfed was high, however, the consumption of minimum acceptable diet was low, and more than half of the children consumed snack foods (such as sweet biscuits, chips, and chocolate) daily across both urban and rural areas. No statistically significant differences regarding breastfeeding and complementary feeding practices were found between rural and urban areas. Maternal school level; number of children and number of antenatal visits were found to be predictors of undernutrition. The findings in this study indicate that suboptimal feeding practices exist across urban and rural areas and emphasize how causes to undernutrition in children are complex, exceeding the sole explanation of demographic location. Promotion of nutritional interventions across urban and rural areas addressing children as early in life as possible is necessary to prevent child undernutrition and the consequences to children's cognitive development, health, and wellbeing.

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Appendix 1: Questionnaire



## Variation in infant feeding practices and nutritional status in Bhaktapur District, Nepal 2017

(१= छ, ०= छैन, ०= No, 1= Yes)

1. आमाको ID नम्बर (ID number of woman).....-
2. बच्चाको ID नम्बर (ID number of child).....-
3. अन्तर्वार्ता मिति (Date of screening).......  
*dd* *mm* *yy*
4. स्थान (Area): आमासमुह= १, घरमा= २, बाहिरक्याम्प= ३.....
5. स्वा. का. कोड (Interviewer's initials): \_\_\_\_\_
6. अन्तरबार्ता शुरु समय (Time start of interview): .....:  
अन्तरबार्ता सकेको समय (Time end of interview): .....:

### Module 1: Background

#### आमाको विवरण (The mother):

7. आमाको उमेर (Mother's age in years) .....
8. विवाहित विवरण (विवाहित =०१, विधवा =०२, सम्बन्ध विच्छेद =०३, छुटिएरबसेको =०४)  
(Marital status: 1 =married, 2=widowed, 3=divorced, 4=separated, 5=husband working abroad) ..
9. विवाह गर्दाको उमेर ? (Age when married?) .....
10. के तपाईं कहिल्यै स्कूल ? (Have you ever attended school?).....  
10.1. यदि , कति सम्म (लेख्ने)  
(If answer yes: Up to what grade/degree? (write): \_\_\_\_\_)
11. हाल तपाईं बाहिर काम गर्नु हुन्छ? (Are you working outside the home at the moment?).....   
11.1. यदि गर्नु हुन्छ भने, के काम गर्नु हुन्छ?  
(If answer yes: What do you do?) \_\_\_\_\_  
11.2. यदि गर्नु हुन्दैन भने पछिल्लो बच्चा जन्मनु अघि काम गर्नु भयेको थियो?  
(If answer no: Did you work before your youngest child was born?).....

12. तपाईंको बच्चाको बुबाले कति क्लास सम्म पढ्नु भएको छ? (ग्रेड वा डिग्री लेख्नुहोस्)  
(What is the highest level of school the father of your child attended? Write grade or degree): \_\_\_\_\_

13. हाल बच्चाको बुबा बाहिर काम गर्नु हुन्छ?  
(Does the father of your child work outside the house at the moment?) .....

13.1. गर्नु हुन्छ भने के काम गर्नु हुन्छ? (**If answer yes:** What does he do?) \_\_\_\_\_

14. तपाइको सासु तपाइसगै बस्नु हुन्छ?  
(Does your mother-in-law live in the same house as you and your family?) .....

15. कति बच्चाहरु तपाईं जन्म दिएको छ? (How many children have you given birth to?) .....

16. हाल कति जिबित बच्चाहरु छन्? (How many children are still living today?) .....

17. तपाईंका पाँच वर्ष भन्दा कम उमेरका बच्चाहरु कति छन् ?  
(How many children do you have under the age of five?) .....

18. तपाईं पछिलो गर्भवती छँदा के तपाईंले कुनै पनि पूरक औषधि लिनुभयो (आइरन, फोलिक एसिड, आदि?)  
(When you were pregnant with your youngest child, did you take any supplements (such as iron, folic acid, etc?) .....

18.1. यदि जवाफ हो भने के हो ? (**If answer yes** What?): \_\_\_\_\_

**सामाजिक र आर्थिक (Socioeconomic status):**

19. के तपाईंको केजात हो ? .....

१= ब्राह्मिन, २= छेत्री, ३ = नेवार, ४= गुरुङ / राई / मगर, ५ = तामाङ / लामा,

६ = चौधरी / मदेशी / मुस्लिम, ७ = दलित, ८ = अन्य

(What caste do you belong to? 1=Bramhin, 2=Chhetri, 3=Newar, 4= Gurung/Rai/Magar, 5= Tamang/lama, 6=Chudahari/Madhese/Muslim, 7= Dalit, 8= other)

20. तपाईंको पारिवारिक सदस्यहरु कतिजना तपाईंको घरमा बस्छन्, जुन रातमा तपाईंको घरमा सुत्छन्?  
(How many people live in your home at the moment, those who sleep in your home at night) .....

21. घरको मुलिको लिङ्ग? (Gender of Head of household) .....

0= पुरुष, १= महिला (0=Male, 1=Female)

97 = Forgot to ask  
0= No 98 = Not answered  
1= Yes 99 = Do not know

22. आफ्नो परिवारको जमिन स्वामित्व छ? (Does your family own land? .....

१= छ, ०= छैन, २= भाडामा, ३= छ तर (0=No, 1=Yes, 2= rented land, 3=owns land in different part of the country )

23. के तपाईंको घरमा पशु/पन्छी छ?

(Do you own livestock (goats, buffalos, cows, chicken, ducks, etc.)?) .....

**If answer yes:**

23.1. भएमा कतिवटा? (How many)? .....

23.2. कुन प्रकारको (What type)? .....

24. तपाईंको घरमा भान्साको लागि छुट्टै कोठा छन्?

(Do you have a separate room for the kitchen?). .....

25. तपाईंको घरमा कति कोठाहरु छन ? (How many rooms are in your home?) .....

26. तपाईंको पिउने पानी कहाँबाट आउँछ? (Where does your drinking water come from?) .....

१= बोतल/जार किनेको पानी, २= कर ३= घर भित्र धाराको पानी,

४= सार्वजनिक धाराबाट, ५= ईनारबाट, ६= हातको पंप, ७= अन्य

(1= bottled mineral water, 2= tanker supply, 3= tap water inside home, 4= tap water from public site, 5= from well, 6= hand pump from well, 7= other)

27. तपाईंको घरमा शौचालय छ? (Do you have your own toilet?) .....

१=छ, ०=छैन, २=अरु एक परिवारसँग, ३=धेरै परिवारसँग (0= No, 1= Yes, 2= Share with one other family, 3= Share with many families)

28. परिवारमा भएको शाधनहरु (Do you have a vehicle?) .....

**If answer yes:**

28.1. कार, गाडी (A car(s)/van(s)/truck(s)).....

28.2. मोटर बाईक, स्कुटर (A motorbike(s)/scooter(s)) .....

28.3. ट्राक्टर (A tractor(s)).....

28.4. साइकल (A bicycle(s)).....

28.5. अन्य (Other (write)) .....

29. नु हुन्छ?

(What do you use for light when there is no electricity?) .....

१= सोलार, २=इन्भर्टर/ ब्याट्री, ३= मट्टीतेल, ४= मैन्बती , ५=अन्य)

(1=solar power, 2=battery lamp/flashlight, 3=oil lamp, 4= candle, 5= other (write) .....

**बच्चाको विवरण (The child):**

30. बच्चाको लिंग (Gender of the child) .....

0 = पुरुष, 1 = महिला (0=Male, 1=Female)

31. कुन दिन, महिना र वर्ष तपाईंको बच्चा जन्मेको थियो

(In what day, month and year was your child born) ?..... ..  
dd mm yy

*यदिजन्म मिति थाहा नभएमा खोपअथवा जन्मकोकार्ड छ हेर्नुस*

**(If the mother does not know the exact birth date of her child, ask for health/vaccination card)**

32. बच्चाको उमेर महिनामा कति भयो? (Child's age in months) .....

33. महिना पुगेर (३७-४२ हफ्ता) जन्मेको हो?

(Did you give birth to your child full term (37-42 weeks)?) .....

33.1.यदि नभएमा कति हप्तामा जन्मेको हो? (**If answer no:** How many weeks early?).....

34. तपाईंको बच्चालाई गएको दुइ हप्तामा पखाला लागेकोथियो?

(Has your child had diarrhoea during the last two weeks?) .....

35. तपाईंको बच्चालाई गएको चार हप्तामा पखाला लागेकोथियो?

(Has your child had diarrhoea during the last month?) .....

36. तपाईंको बच्चालाई गएको दुइ हप्तामा अन्य रोग हरु लागेकोथियो?

(Has your child had any other disease during the last two weeks?) .....

37. तपाईंको बच्चालाई गएको चार हप्तामा अन्य रोग हरु लागेकोथियो?

(Has your child had any other disease during the last month?).....

37.1.यदि भएमा कुन? (**If answer yes,** Write which): \_\_\_\_\_

38. बच्चालाई केहि दिर्घ रोग हरु छ? Does your child have any chronic conditions?.....

38.1.यदि भएमा कुन ? (**If answer yes,** Write which): \_\_\_\_\_

**Antenatal and postnatal care:**

39. तपाईंले यस गर्भावस्थाको बेला कहिं जांचको लागि जानुभएको छ ? यदि जांचको लागि कहिं जानुभएको भए, कहा?

(Did you see anyone for a check-up during this pregnancy?).....

**If answer yes:**

39.1. कहा जचाएको? (Where did you go?) .....

१= सरकारी अस्पतालमा, २= हेल्थ पोस्त, ३= प्राइभेट अस्पतालमा/क्लिनिक, ४= अन्य  
(1= hospital (government), 2= primary health care centre, 3=private health care centre, 4= other  
(write).....)

39.2. यस गर्भावस्थाको समयमा तपाईंले कति पटक जांच गर्नुभयो?

(How many times did you receive check-up during this pregnancy?) .....

40. बच्चा कहाँ जन्मेको थियो ? (Where was the child born?) .....

१= घरमा स्वस्थ्य कार्यकर्ता को सहयोग बिना, २= घरमा स्वस्थ्य कार्यकर्ताको सहयोग मार्फत, ३= सरकारी अस्पतालमा, ४= हेल्थ पोस्त, ५= प्राइभेट अस्पतालमा, ६=अन्य)  
(1= at home without help from health professional, 2= at home with help from health professional, 3=government hospital, 4=health post, 5=private hospital, 6=other)

41. कस्तो प्रकारको जन्म? (What was the circumstance of the delivery?) .....

१= सामान्य, २= अप्रेसन, ३= अन्य (1= normal, 2=caesarean section, 3= other)

42. बच्चा जन्मनासाथ छातिमा राख्यो ?

(Immediately after the birth, was the child put on your chest?) .....

**Module 2: Breastfeeding and Complementary feeding:**

**स्तनपान र अन्य खाना**

*Modified from the WHO's Indicators for assessing infant and young child feeding practices*

43. के बच्चालाई स्तनपान गरिएको थियो? (Has the child ever been breastfed)? .....

44. बच्चालाई बिगौति दुध दिनु भएको थियो? (Did the child receive the first milk (colostrum)?)

45. के तपाईंले स्तनपान गर्न अघि कुनै अन्य खाना दिनुभयो? यदि भएमा कुन?

(Did you give any other food before breastfeeding?) .....

45.1. यदि भएमा कुन (**If answer yes:** What write):.....

46. बच्चा जन्मे पछि तपाईंले स्तनपान कति समय पछि गर्न शुरु गर्नुभयो?

(How long time after birth did you start breastfeeding this child?) .....

0= स्तनपान गरेको छैन, १= पहिलो घण्टा भित्र, २= पहिलो ६ घण्टा भित्र,  
 ३= अर्को ६- २४ घण्टामा, ४= २४ घण्टा पछि)

(0= not breastfed, 1= within the first hour, 2= within the first 6 hours, 3= within the next 6-24 hours,  
 4=after 24 hours)

47. हाल स्तनपान गरिरहनु भएको छ? (Do you still breastfeed your child?) .....

47.1. यदि भएमा, तपाईं आफ्नो बच्चालाई हिजो स्तनपान गराउनु भयो?

(If answer yes: Did you breastfeed your child yesterday?) .....

47.2. यदि छैन भने तपाईंले आफ्नो बच्चालाई कति महिनासम्म स्तनपान गराउनु भयो?

(If answer no: Until what month of the year did you breastfeed your child?) .....

48. हिजो बच्चालाई चम्चा, कप वा बोतल बाट आमाको अथवा अरु आमाको स्तनपान गराउनु भएको थियो? (Did the child consume breast milk (from mother or from other woman) by spoon, cup, or bottle yesterday during the day or at night?) .....

48.1. यदि भएमा कुन (If answer yes: which write) \_\_\_\_\_

49. गत छ महिनामा, बच्चालाई भिटामिन ए खुवाई दिइयो?

(In the last six months, was the child given a vitamin A dose?) .....

50. हिजो कुनै भिटामिन अथवा अन्य औषधि दिनु भएको थियो ? (Was the child given any vitamin

drops or other medicines as drops yesterday during the day or at night?) .....

### 24 hour recall:

आमालाई अब हामीले हिजो दिनभरिखान के के दिनु भयो सोध्छौं

We will now ask you about what your child drank and ate yesterday (from your child woke up yesterday until your child woke up today).

51. Did the child have any of the following liquids:

- |  |   |
|--|---|
| a. साधा पानी (Plain water)?..... <input type="checkbox"/>          | e. दुध (Milk such as powdered, tinned,<br>fresh animal milk, milk tea)?..... <input type="checkbox"/> |
| b. बोत्तल को दुध (Infant formula) ? ..... <input type="checkbox"/> | f. दहि (Yoghurt/curd)?..... <input type="checkbox"/>  |
| c. जुस (Juice or juice drinks)?..... <input type="checkbox"/>      | g. अन्य झोल (Any other liquids)?..... <input type="checkbox"/>  |
| d. सुप (Clear soup)?..... <input type="checkbox"/>                 |   |

97 = Forgot to ask  
 0= No 98 = Not answered  
 1= Yes 99 = Do not know

52. हिजो दिन भर बच्चाले दिउसो र राती घरमा र बाहिर खाएको खाजा/खानाको बारे भन्नुस  
 (Please describe the foods (meals and snacks) that your child ate **yesterday during the day and night**,  
 whether **at home or outside the home.**)

(When composite dishes are mentioned, ask for the list of ingredients.)

खानेकुराको विवरण (Food items)	
Time:	
Time:	
Time:	
Time:	
Time:	
Time:	
Time:	

Use the list below to go through foods they might have forgotten (see list).

**List of foods**

माथिको हिजो को खानाको विवरण लिए पछि तलको लिस्ट अनुसार सोधनुस ता कि आमाले केहि पानी  
 खाना भन्न नाबिसर्योस र केहि छुटिएको भए थप्नुस

(Go through this list after you have done the 24HR recall, to make sure that the mothers did not forget any  
 foods. Add specified foods to the list above or Circle if they have forgotten any of the following foods):

- A. रोटि, पाउरोटी, भात, चाउचाउ, वा अन्य खाना जुन चामल, गहुँ, कोदो वा जौ बाट बनेको  
 खाएको थियो? (Porridge (Lito,etc.), bread (roti, chapati, etc), rice, noodles, or other foods made  
 from grains)
- B. फर्सि,गाँजर, स्कूस, पहेलो र सुन्तला रंगको फलफुल (Pumpkin, carrots, squash, or sweet potatoes  
 that are yellow or orange inside)
- C. के बच्चालेआलु, तरुल, कल्कलो वा अन्य जमिन मुनि पाउने खाना हिजो खाएको  
 थियो? (White potatoes, arrowroot, white yams, manioc, cassava, or any other foods made from  
 roots)
- D. के बच्चाले गेडागुडी, दाल वा बदाम खाएको थियो? (Any foods made from beans, peas,  
 lentils, nuts, or seeds)

- E. सागसब्जी जस्तै रायो, तोरी खाएको थियो? (Any dark green leafy vegetables (like spinach, mustard greens, cress, etc))
- F. आप, मेवा (Ripe mangoes, ripe papayas, (high in vitamin A))
- G. के बच्चाले कुनै अन्य साग वा फलफुल खाएको थियो? (Any other fruits or vegetables)
- H. के बच्चाले कुनै बंगुर, खसी, बोका, कुखुरा, हाँस, अरु चरा, कलेजो, मृगौला, मुटु खाएको थियो (Liver, kidney, heart, or other organ meats, Any meat, such as buffalo, pork, lamb, goat, chicken, or duck)
- I. के बच्चालेअन्डा खाएको थियो? (Eggs)
- J. के बच्चाले ताजा वा सुकेको माछा वा कत्ले माछा खाएको थियो? (Fresh or dried fish, shellfish, or seafood)
- K. के बच्चालेदुध, दहि, छुर्पी वा अन्य दुग्ध पदार्थ खाएको थियो? (Cheese, curd, yoghurt or other milk products)
- L. के बच्चाले कुनै खाना जुन तेल, घिउ वा मकखन बाट बनेको खाएको थियो? (Any oil, fats, or butter, ghee, or foods made with any of these)
- M. गुलियो चिज जस्तै मिठाई, केक, बिस्कुट आदि (Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits)
- N. मसला, खोर्सानी, माछाको पाउडर (Condiments for flavour, such as chillies, spices, herbs, or fish powder)
- O. Snails, grubs, or insects

53. बच्चाको हिजो को खाना सधैं खाने जस्तै थियो? (जस्तै केहि बिरामी थिएन र केहि भोज/उत्सव पानी थिएन (Did your child eat like normal yesterday? (Was yesterday a usual day, for example no illness or special occasion like a celebration)) .....

53.1. यदि उतर थिएन भने आएमा, किन थिएन उलेख गर्नुस

(If answer no: Write why not?): \_\_\_\_\_

54. If attending mother's group: How many months old was the child when first attending mother's group? .....

### Modul 3: Anthropometry for Nutritional status of the child

55. तौल (के.जी.) (What is the weight of the child?).....   .  kg

56. लुगाको तौल (What was the **estimated** weight of the clothes).....  .  kg

57. लम्बाई (से.मी.) (What is the length of the child?).....    .  cm

Observation notes:



Appendix 2: Letter of consent in Nepali

**सुसुचित जानकारी फारम**  
**“Infant feeding practices, nutritional status, and health service delivery in Bhaktapur District”**

जन्मेदेखि २४ महिना सम्मका बच्चाहरुको स्तनपान, पुरक खाना र खानपिनको अवस्था साथै स्वास्थ्य मा पहुच थाहा पाउन भक्तपुर का तिन समुहका आमा हरु सँग हामीले अनुसन्धान गरिरहेका छौ। यदि तपाईं समावेश हुन चाहनु हुन्छ भने तपाईंको पछिल्लो बच्चाको जन्म, स्वास्थ्य अवस्थाबारे कुरा गर्ने छौ। हामिले तपाईंको घर परिवारको र बच्चाको खानपिनको बिबरन पनि लिनेछौ। हामीले बच्चाको तौल र उचाई पनि मापन गर्ने छौ।

तपाईं तथा तपाईंको परिवार यस अनुसन्धानमा सहभागिताको लागि अनुरोध गरिएको छ किन कि तपाईंको बच्चा उपयुक्त उमेर समुहको छ र चिमालय च्यारिति को कुनै कार्यक्रममा भाग लिनु भएको छ। हामिले दुइ वर्ष मुनिको बच्चा (बाबु वा नानु) साथै उनिहरुका आमाहरुलाई यस सर्वेमा समावेश गरेका छौ। तपाईंले दिनु भएको जवाफहरुमा कतै नाम उलेख्न नहुने भएकोले तपाईंको कुनै पहिचान खुल्ने छैन। यो सर्वे को प्रयोगको लागि मात्र छुत्तै कोद नम्बर को प्रयोग गर्ने छ। तपाईं तथा तपाईंको बच्चाको यो सर्वेमा सहभागिताले र तपाईंले दिनु भएको जानकारीहरुले भक्तपुरमा बच्चाहरुको खानपिन बारे थाहा पाउन मद्दत मिल्ने छ र तपाईंको सहभागिताको लागि हामि धेरै आभारि छौ। यस अध्ययनमा तपाईंको सहभागिता स्वेच्छिक हुनेछ। तपाईंको भाग लिने नलिने निर्णयले यस परियोजना को भविष्यमा असर गर्नेछैन। यदि तपाईंले भाग लिनुभयो भने, तपाईं कुनै पनि समयमा रोक्न सक्नुहुन्छ। यसको अतिरिक्त, अनुसन्धान गरिसकेपछि तपाईंले तपाईंको डेटा अध्ययनबाट फिर्ता लिनु अनुरोध गर्न सक्नुहुन्छ।

यो सर्वे चिमालय च्यारिति र ओस्लो र अकर्सुस बिश्वबिध्यालयको संयुक्त समन्वय मा सन्चालन गरिएकोछ।

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म सर्वेमा भाग लिन सहमत छु र मेरो बच्चालाई पनि सहभागी गर्न चाहन्छु मलाई के गर्नु पर्छ भनि जानकारी भयो।

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हस्ताक्षर

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मिति

Appendix 3: Letter of consent in English

# **Consent form to participate in a study on infant feeding practices, nutritional status, and health service delivery in Bhaktapur District.**

We are conducting research to describe nutritional status, breastfeeding- and complementary feeding practices among children 0-24 months of age and exploring the access to health care services in three different population groups in the Bhaktapur district.

If you decide to participate we would like to talk with you about your experiences with giving birth to your last-born child, and the health status of your child. We will also be asking you questions about your background, your household and child feeding practices. We will also measure the weight and height of your child.

You and your family are being asked to participate in this study as you have a child in the relevant age group and may have been participating in one or more of Chimalaya Charity's programs. We are selecting children (boys and girls) who are younger than two years old and their mothers to participate in the survey. You will be anonymous in the way that no names will be on the form where your answers are filled in. An ID number will be made up just for this survey.

If you and your child take part in this project you will provide information that will help us to understand factors influencing infant and complementary feeding practices in Bhaktapur district, and we would very much appreciate your participation in this survey.

Taking part in this project is entirely up to you, and no one will hold it against you or your child if you decide not to participate. If you take part, you may stop at any time. In addition, you may ask to have your data withdrawn from the study after the research has been conducted.

The survey is a collaboration between the Chimalaya Charity in Nepal and Oslo and Akershus University College.

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**I agree to take part and to also let my child take part in this project. I know what we must do and that we can stop at any time.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



Appendix 4: Norwegian Center for Research Data receipt

Sigrun Henjum  
Postboks 4 St. Olavs plass  
0130 OSLO

Vår dato: 23.03.2018

Vår ref: 59791 / 3 / HJP

Deres dato:

Deres ref:

## Tilråding fra NSD Personvernombudet for forskning § 7-27

Personvernombudet for forskning viser til meldeskjema mottatt 12.03.2018 for prosjektet:

59791	<i>Variation in infant feeding practices and nutritional status across socio-economic groups in Kathmandu Valley, Nepal</i>
Behandlingsansvarlig	Høgskolen i Oslo og Akershus, ved institusjonens øverste leder
Daglig ansvarlig	Sigrun Henjum
Student	Camilla Haugstveit Warren

### Vurdering

Etter gjennomgang av opplysningene i meldeskjemaet og øvrig dokumentasjon finner vi at prosjektet er unntatt konsesjonsplikt og at personopplysningene som blir samlet inn i dette prosjektet er regulert av § 7-27 i personopplysningsforskriften. På den neste siden er vår vurdering av prosjektopplegget slik det er meldt til oss. Du kan nå gå i gang med å behandle personopplysninger.

### Vilkår for vår anbefaling

Vår anbefaling forutsetter at du gjennomfører prosjektet i tråd med:

- opplysningene gitt i meldeskjemaet og øvrig dokumentasjon
- vår prosjektvurdering, se side 2
- eventuell korrespondanse med oss

### Meld fra hvis du gjør vesentlige endringer i prosjektet

Dersom prosjektet endrer seg, kan det være nødvendig å sende inn endringsmelding. På våre nettsider finner du svar på hvilke [endringer](#) du må melde, samt endringskjema.

### Opplysninger om prosjektet blir lagt ut på våre nettsider og i Meldingsarkivet

Vi har lagt ut opplysninger om prosjektet på nettsidene våre. Alle våre institusjoner har også tilgang til egne prosjekter i [Meldingsarkivet](#).

### Vi tar kontakt om status for behandling av personopplysninger ved prosjektslutt

Ved prosjektslutt 15.06.2018 vil vi ta kontakt for å avklare status for behandlingen av personopplysninger.

*Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.*

Se våre nettsider eller ta kontakt dersom du har spørsmål. Vi ønsker lykke til med prosjektet!

Vennlig hilsen

Dag Kiberg

Hanne Johansen-Pekovic

Kontaktperson: Hanne Johansen-Pekovic tlf: 55 58 31 18 / [hanne.johansen-pekovic@nsd.no](mailto:hanne.johansen-pekovic@nsd.no)

Vedlegg: Prosjektvurdering

Kopi: Camilla Haugstveit Warren, [s294319@stud.hioa.no](mailto:s294319@stud.hioa.no)



### TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Personvernombudet registrerer at datainnsamlingen allerede er utført. Vi finner dette uheldig, og minner om at prosjekter som omfattes av meldeplikten skal meldes senest 30 dager før oppstart. Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger omfattes av meldeplikten.

I telefon 20.03.18 har studenten forklart at prosjektet ble meldt til REK høsten 2017. Prosjektet ble vurdert som ikke meldepliktig til REK, og ifølge studenten glemte både hun og veileder å søke NSD - Personvernombudet for forskning. Vi oppfordrer veileder og institusjonen til å gjennomgå sine rutiner for å sikre at prosjekter som faller utenfor REK sitt mandat, blir meldt til NSD.

### PROSJEKTVURDERING

Prosjektet har som formål å undersøke ernæringsstatus, amming og matvaner blant barn fra 0-24 måneder, og tilgangen til helsetjenester, i tre forskjellige befolkningsgrupper i Bhaktapur-distriktet/Nepal. Prosjektet er et samarbeid mellom HiOA og en lokal NGO. HiOA er behandlingsansvarlig institusjon, og det er kun student og veileder ved HiOA som har tilgang til datamateriale med personopplysninger. NGOen har bistått med rekruttering og innsamling av datamateriale.

### UTVALG

Utvalget består av 111 kvinner med barn i alderen 0 - 2 år. Datamateriale har vært samlet inn via personlige intervjuer, der assistenter har fylt ut et spørreskjema på papir med deltagerne. Det er ikke samlet inn direkte identifiserende opplysninger.

### INFORMASJON OG SAMTYKKE

Det er i meldeskjema lagt opp til muntlig og skriftlig informasjon. Tilbakemeldingen vår er basert på den skriftlige informasjonen. Informasjonsskrivet som er delt ut til utvalget er i hovedsak godt utformet ved at formålet er godt beskrevet, det er oppgitt at enkeltpersoner ikke skal kunne gjenkjennes, det er tydelig uttrykt at det er frivillig å delta, at deltager kan trekke seg når som helst, og videre at deltagelse ikke vil påvirke relasjonen til NGOen. Det er derimot ikke avklart at HiOA er behandlingsansvarlige institusjon, eller gitt kontaktopplysninger til student/veileder. Siden det ikke er samlet inn direkte identifiserende opplysninger eller kontaktopplysninger for utvalget anser studenten det som usannsynlig å kunne kontakte utvalget med utfyllende informasjon. Ved vurdering av om det er gitt et gyldig samtykke, tar Personvernombudet høyde for at manglende informasjon kan være gitt muntlig til utvalget ved personlig intervju, og videre at utvalget kan kontakte NGO ved spørsmål til studiet og for kontakt med student/veileder. Vi finner på bakgrunn av dette at utvalget er gitt tilstrekkelig informasjon.

### DATAMATERIALET

Etter en helhetsvurdering av prosjektet, og på bakgrunn av at det er samlet inn opplysninger om blant annet



amming og kosthold, finner vi at datamaterialet inneholder sensitive opplysninger om helseforhold.

#### INFORMASJONSSIKKERHET

Personvernombudet forutsetter at du behandler alle data i tråd med Høgskolen i Oslo og Akershus sine retningslinjer for datahåndtering og informasjonssikkerhet.

#### PROSJEKTLUTT OG ANONYMISERING

Prosjektlutt er oppgitt til 15.06.2018. Det fremgår av meldeskjema at du vil anonymisere datamaterialet ved prosjektlutt.

Anonymisering innebærer vanligvis å:

- slette eller omskrive/gruppere indirekte identifiserbare opplysninger som bosted/arbeidssted, alder, kjønn

For en utdypende beskrivelse av anonymisering av personopplysninger, se Datatilsynets veileder:

<https://www.datatilsynet.no/globalassets/global/regelverk-skjema/veiledere/anonymisering-veileder-041115.pdf>